SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1897, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXVII.—No. 11. ESTABLISHED 1845. NEW YORK, SEPTEMBER 11, 1897. $3.00 A YEAR. WEEKLY.

HOW TO BUILD A SMALL ALTERNATING CURRENT DYNAMO WITHOUT CASTINGS.

BY NEVIL MONROE HOPKINS.

Numerous small books have been published on dynamo building, but they have been mainly devoted to descriptions of direct current generators. The little machine described in the following article produces a "single phase" alternating current at 110 volts pressure, and is built without patterns and castings. The making of small dynamos is frequently given up by amateurs because patterns and castings are required. Patterns are often troublesome and expensive to make, and iron castings are not always procurable in the average town. The iron ring which forms the frame or body of the alternator described in this connection can be quickly made by almost any blacksmith, and is to be preferred to a casting if made from good soft iron. For a larger dynamo than the one described the iron ring can be very easily made by using blacksmith's rollers, known as tire benders. The little machine, when its field magnets are only feebly excited, generates the most approved kind of alternating current for medical purposes, as the voltage is steady; consequently furnishing a current which is free from the jerking or twitching sensation so common with the use of induction coils. With the fields strongly magnetized the machine, when run at about 2,000 revolutions per minute, is capable of lighting a 50 candle power 110 volt lamp. As the designing of alternate current dynamos, mathematically considered, is rather beyond the average amateur, the author merely gives the result of calculations, except in the matter of field magnet winding, where a choice of wire presents itself, in order that the field magnets made shall be suitable for any exciting current at the command of the user. The mathematical designing of alternator armatures would take up more space than our limits allow. The armature as described is readily detachable from the shaft and collector rings, leaving an excellent field for experimentation with different types of armature cores and windings.

The electrical engineer whose knowledge becomes deficient when he leaves direct current dynamo machinery and deals with generators of alternating type has a very limited field for practice, as the alternating current machine has come to the front to remain, displacing the direct current generator in many important branches of electrical engineering. There are to-day many electrical men who are at home, so to speak, when dealing with the applications of current electricity, and are badly at sea when they meet with problems pertaining to alternating currents. The alternator we are about to build is the simplest form at present in actual use, being excited by a battery, or other source of direct current, and delivering, in place of the mechanical power required to drive it, an alternating current, known as a "single phase." Alternators are built for lighting and power transmission, both "single phase" and "polyphase," although the "polyphase" generators are principally employed for power transmission. In the alternating current dynamo the voltage rises and falls in a very rapid periodic manner, driving a wave of electricity first in one direction, then in the reverse, with great rapidity. The field magnets can be considered entirely apart from the armature in a separately excited machine, whether the armature is of the tooth type or ring type. The only relation which we need consider in the machine which we are building is in the number of field magnets. If we use ten field magnets and consequently ten poles, we must make the armature with ten teeth, if of the tooth type; or, should we make a ring armature, the ring must be wound with ten coils equidistant. The armature given is the tooth type, but is conveniently removed, leaving the shaft and hub to receive a ring armature, with the collector rings ready to be connected to the new and differently designed armature. The term "period" used in connection with an alternator denotes the time elapsing between one complete reversal of the current. The "frequency" is the number of double reversals of the current per second. The frequency varies in practice between 150 and 25. It will be readily seen that the greater the number of poles and the greater the speed at which the machine is driven, the greater will be the frequency. Alternators are invariably designed with more pole pieces than direct current machines, in order to get the required number of reversals of the current every second. If the frequency is not high enough, lamps, for instance, in circuit, would flicker. If only two or four poles were employed in our alternator, the armature would have to revolve at a dangerously high speed to obtain the required frequency. The number of pole pieces for alternators vary from six to one hundred and over. The largest slow speed machines which are designed for direct connection to the driving engine have over one hundred poles. Alternators for commercial use are usually designed to give a voltage between 1,000 and 3,000. This high voltage is desirable for power transmission at great distances, whether for lighting or motor work. By the use of transformers immersed in oil for high insulation, the voltage is conveniently "stepped up" to 30,000 and power transmitted one hundred miles, and "stepped down" by transformers to any voltage desired. The transformations of current and voltage without altering the actual value, or electrical horse power, are very beautiful. For example, if we have at hand 25 amperes at 2,000 volts tension, or pressure, we may exchange the 2,000 volts for more amperes and vice versa without altering the power to do work, which is the definition of energy. An armature could, of course, be wound to produce a current at 20,000 volts, but the all-important electrical term "insulation" would forbid it. Assuming the machine were wound for 20,000 volts, the amperage would only be 2·5. Again, should an accident happen to the transformer insulation, when under the tension of 20,000 volts, the primary and secondary windings might come

(Continued on page 165.)

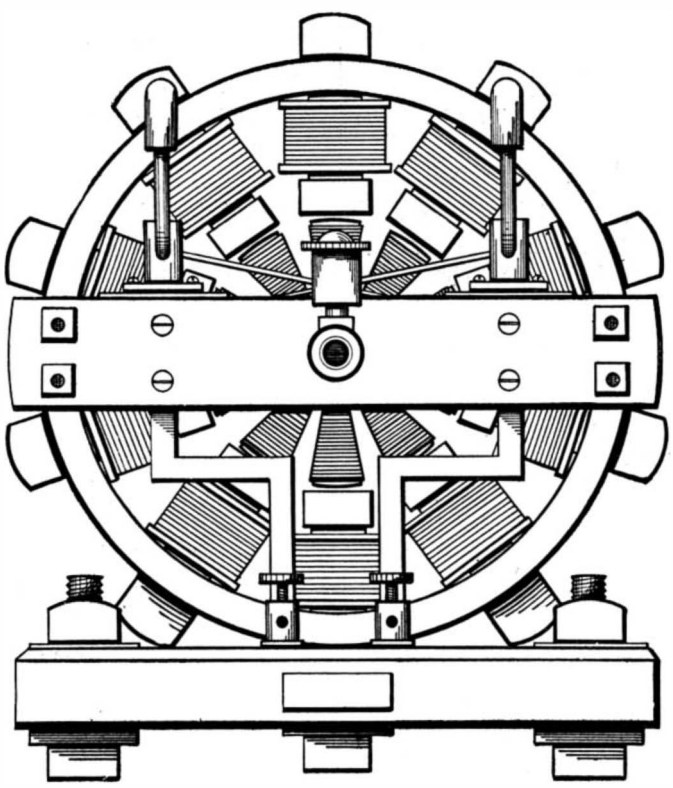


Fig. 1.

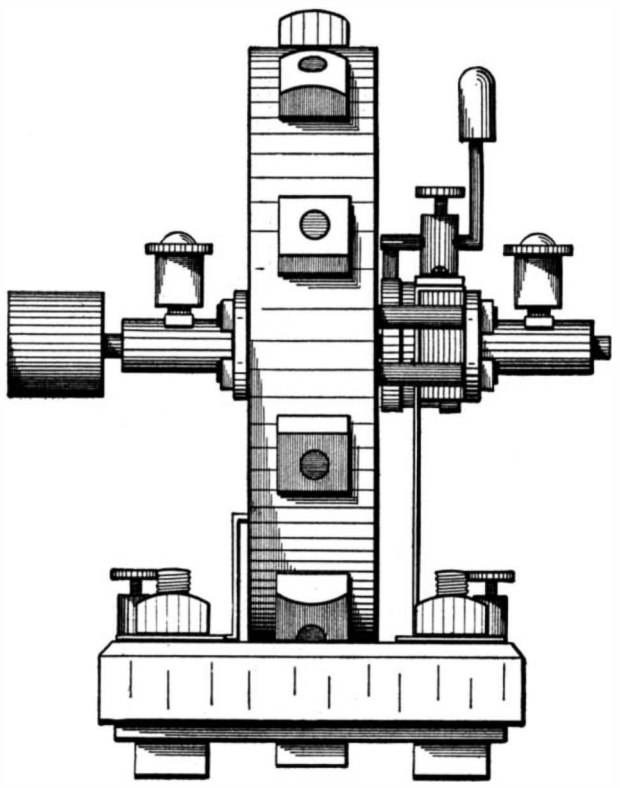
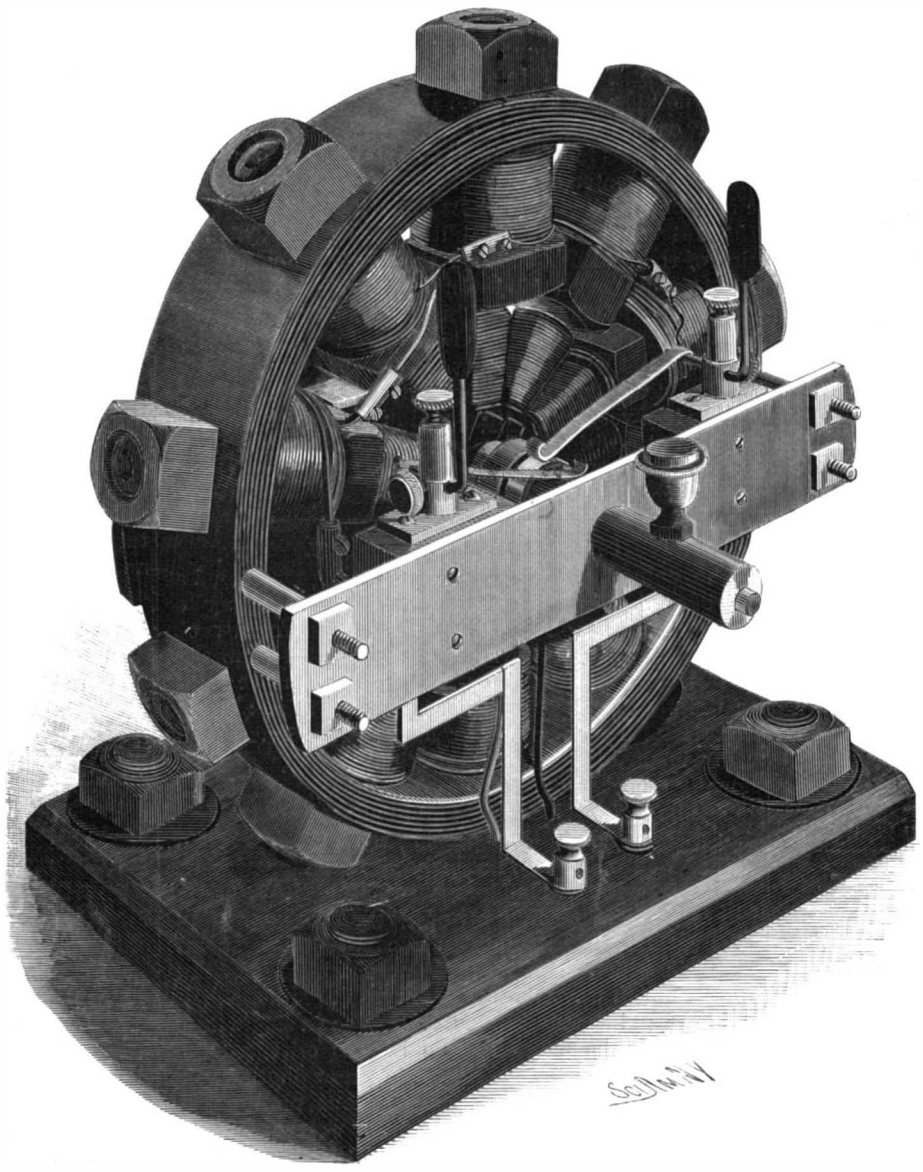
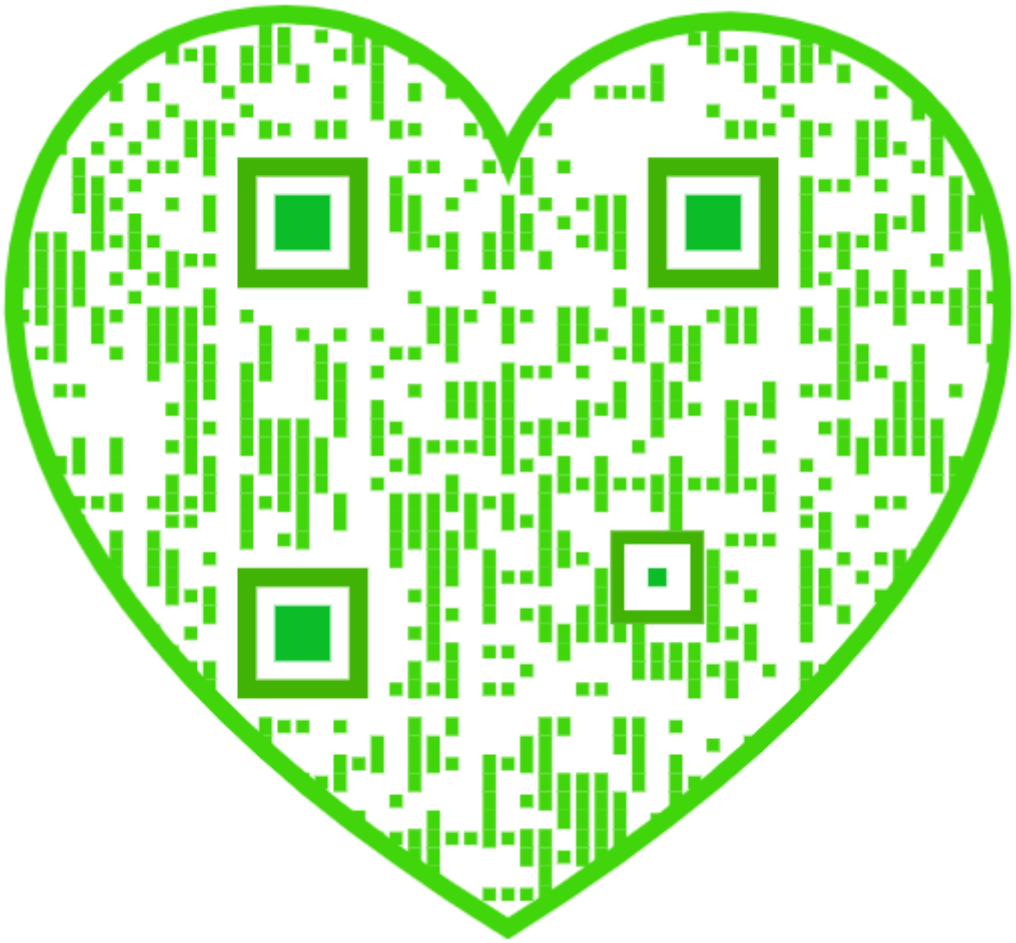


Fig. 2.



A HOME-MADE ALTERNATING CURRENT DYNAMO.

© 1897 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.
(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3.00
One copy, six months, for the U. S., Canada or Mexico..... 1.50
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

The Scientific American Supplement
(Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year, or £1 4s. 8d., to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries, *eight dollars and fifty cents a year*, or £1 14s. 11d., postage prepaid.

Building Edition of Scientific American.
(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders, and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign countries, $3.00 a year, or £0 12s. 4d. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign countries, $6.50 a year, or £1 6s. 9d. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN, and SUPPLEMENT, $9.00 a year. To foreign countries, $11.00 a year, or £2 5s. 2d., postage prepaid.

Export Edition of the Scientific American
(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, or £0 12s. 4d., postpaid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, SEPTEMBER 11, 1897.

Contents.

(Illustrated articles are marked with an asterisk.)

Animal and plant growth..... 162
Antiquity of man in America.... 162
Archæological news..... 170
"Arch Rock," San Francisco Bay*..... 171
Beer pipe cleaner, Gaynor's*.... 164
Boiler tube corrosion*..... 168
Books, new..... 173
Bottle, non-refillable, Springfield's*..... 164
Brain, the, affected by worry.... 168
British Association meeting—II 162
Diving bell, a great..... 169
Dynamo, how to build*..... 161
Electrical work for amateurs*... 161
Electricity, what is it?..... 163
Electric meters..... 162
Eye sanitation..... 170
Fireflies, light of..... 163
Fire, the Paris bazar..... 164
Fog, the dangers of..... 169
Geology of the Yukon region... 171
Harps, strings for (7204)..... 173
Honey and bee keeping..... 167
Inventions recently patented.... 172
Lawn sprinkler, White's*..... 164
Magnetism, variation of earth... 163
Mail bag catching and delivering* 168
Mask, a Carthaginian..... 168
Miner's concentrator, Moore's*.. 164
Panama Canal condition..... 164
Patent competitions, disreputable..... 170
Patents granted, weekly record 173
Philippium, a new element..... 169
Photographic light of fireflies... 163
Physicians, a congress of..... 163
Polar expedition, the Jackson... 167
Railway mail catcher and deliverer, Winsor's*..... 168
Railway, new, in China..... 163
Science notes..... 170
Scientific truth in art..... 162
Screw propeller, repairing..... 162
Subway, the Boston..... 163
Vital processes in animals and plants..... 162
Vistascope, Eddy's..... 167
Weeds, the most troublesome... 172
Yukon region, geology of the.... 171

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1132.

For the Week Ending September 11, 1897.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARCHÆOLOGY.—Address by Sir JOHN EVANS.—A continuation of the address of the great anthropologist..... 18092
The Story of the Philadelphia Expedition.—Explorations of the University of Pennsylvania in Babylonia.—A review of "Nippur; or, Explorations and Adventures on the Euphrates"..... 18091

II. BIOGRAPHY.—Edward Drinker Cope, Naturalist.—The conclusion of this interesting biographical sketch..... 18092

III. BOTANY AND HORTICULTURE.—Aristolochia Goldieana.—1 illustration..... 18091

IV. ELECTRICITY.—Electric Traction at Paris.—A description of a new method of electric traction in Paris, working by accumulators.—3 illustrations..... 18094
Some Electrical Sport.—JAMES F. HOBART.—Description of the method of making an electric flash light.—1 illustration..... 18094

V. GEOLOGY.—The British Association.—Address in Geology.—An address by Prof. G. M. DAWSON..... 18089

VI. MATHEMATICS.—British Association.—Address in Mathematics and Physics.—An address by Prof. A. R. FORSYTH..... 18099

VII. MECHANICAL ENGINEERING.—Machine Moulded Wheels.—3 illustrations..... 18099

VIII.—MEDICINE.—Dr. Mount Bleyer's Treatment for Consumption by Electricity.—On the application of the principles underlying these experiments in the sterilization of lung tissue in tuberculosis.—The primary action of the galvanic current.—It increases the amount of ozone in the blood, as shown by chemical test of the blood in the arteries.—With his theory of animal electricity..... 18100
The Influence of Light on the Skin..... 18101
Electric Light in Rheumatism..... 18102

IX. METEOROLOGY.—The Mount Etna Observatory.—A description of the observatory erected on the largest volcano in Europe.—5 illustrations..... 18090

X. MISCELLANEOUS.—Lighthouse Progress, 1887-1897.—A review of the progress in lighthouse affairs for the last ten years..... 18095
Engineering Notes..... 18097
Electrical Notes..... 18097
Selected Formulæ..... 18097

XI. NATURAL HISTORY.—The Turanian or Aral Tiger in the Zoological Gardens at Berlin, Germany.—1 illustration..... 18089

XII. PHYSICS.—British Association.—Addresses in mathematics and physics.—An address by Prof. A. R. FORSYTH..... 18099

XIII. TECHNOLOGY.—Cuinat's Acetylene Gas Generator.—3 illustrations..... 18100

XIV. TRAVEL AND EXPLORATION.—The Klondike Gold Fields.—By H. K. CARROLL.—A most interesting account of the newly discovered Eldorado, with views of a departing steamer, a map of Alaska, and a view of the Chilkoot Pass.—3 illustrations..... 18087
Hagenbeck's Panorama of a Northern Sea.—1 illustration..... 18098

THE ANTIQUITY OF MAN IN AMERICA.

Sir John Evans, the new president of the British Association, has attacked our paleolithic pretensions. For years it has been thought that the State of New Jersey was at one time inhabited by men who were the contemporaries of the post-glacial men of Europe. Sir John Evans, the highest living authority on the antiquity of man, tells us the chipped stone implements found in the Trenton gravels are not paleolithic at all, but were probably made by the red Indians. Such words coming from so eminent an anthropologist will probably cause a re-examination of the entire subject of the Trenton implements now that the ax of scientific doubt has assailed the family line ascendant of the original inhabitants of America.

Chipped flint weapons, which showed no signs of grinding and polishing, totally unlike those found at the surface, have been discovered at the bottom of thick beds of gravel in the valley of the Somme, at Amiens and Abbeville. From the nature of the evidence these implements showed the handiwork of man who existed after the glacial period. On the floor of caves chipped stone weapons were found which had been overlaid by a thick layer of stalagmite, which forms with extreme slowness. On the top of the stalagmite, neolithic or polished stone weapons were also found. Now between the handiwork of these two races of man ages must have passed sufficient for an entire change of climate and fauna. It was at this point of the discourse that Sir John impugned the authenticity of our glacial pedigree. He declared his firm conviction that the American relics were of neolithic, and therefore of far less antiquity than the rudely fashioned relics found in the valleys of the Seine and the Somme.

If the American relics could be shown to have been the work of people existing shortly after the glacial period, it is plain from their superior workmanship that the paleontological man in America must have possessed greater intelligence than the man of the Somme Valley. What militates against this view of the paleolithic man in America is that implements of a similar type to those of the Trenton drift have been found in some of the disused quarries in which the red Indians fabricated their weapons.

Our own men of science have long believed that they saw in these stone implements the work of men who inhabited this continent just after the glacial period. If, after a critical examination of the whole question, it is decided that the weapons are paleolithic and not neolithic, we can only conclude that the development of intelligence was more rapid on the western shores of the Atlantic than on the eastern, and there is little fear that our native paleoliths will lack defenders.

REPAIRING THE SCREW PROPELLER OF A TRANSATLANTIC STEAMER.

The chief engineer, A. Witte, of the North German Lloyd steamer Barbarossa succeeded recently in removing the remnants of a lost screw blade and affixing a new blade without taking the steamer from its dock, and placing it in a dry dock, as is usually done when making such repairs. In order to bring the propeller out of the water for making the repairs, the compartments in the bow of the steamer were allowed to fill with water so that the steamer assumed an inclined position, with the bow twenty-four feet down in the water and the stern but twelve feet. This position of the steamer exposed the screw propeller shaft and the uppermost blades sufficiently above the water to permit of removing the broken blade and replacing it by a reserve blade carried on board. The new blade was four feet wide and eight feet long. After the blade was affixed, the front compartments were pumped empty in a very short time, and the steamer assumed its normal position and was ready to sail on schedule time, the whole work taking but a little more than a day's time.

SCIENTIFIC TRUTH IN ART.

The painter and the poet are hardly considered as good guides in scientific matters. Cosmogony or natural history constructed on their lines would probably be fearful and wonderful. So-called "poetical license," which means in plain English that the poet or the painter has a dispensation to take amazing liberties with events or natural laws, is condoned in the men who deal in imagination rather than facts. Occasionally a poet or a painter by the exercise of intuitive genius has set forth a great fact in advance of its scientific ascertainment, thus playing the part of a seer as well as a chronicler. Those who are familiar with the works of the English landscape painter J. M. W. Turner will remember that in many of his pictures he portrayed lightning flashes not in conventional academic forms in which straight lines were broken at sharp angles, but in wavy lines with curves instead of angles, and here and there with double lines for a single flash. At the time he painted them he was criticised and almost unanimously condemned, but now photography has come to his aid and instantaneous photographs show that his portrayal of lightning was so scientifically exact that he really anticipated the discoveries of science by half a century. We shall probably never know how Turner mastered the electric flash, which is the most bewildering and most evanescent of all things, and where scientific investigators who apparently had a stronger motive for ascertaining the exact truth, fail, he succeeded, though he might be supposed to have been moved chiefly by his plastic sense with no reference to scientific accuracy.

THE BRITISH ASSOCIATION MEETING.—II.

In addition to the mention in last week's issue of the SCIENTIFIC AMERICAN of papers presented at the recent meeting of the British Association at Toronto, we subjoin a brief synopsis of what was said by some other eminent scientists at the meeting. Prof. A. W. Walker, lecturer in St. Mary's Hospital, London, presented some curious records, obtained photographically, showing the

EFFECT OF VARIOUS DRUGS ON THE NERVES.

He had two sets of electric wires connected with the nerve of an animal that was the subject of his experiment. One set was so attached as to impart a shock to the nerve whenever the circuit was closed. The other was connected in such a way as to register any sympathetic electric current produced in the nerve itself at a short distance from the point of excitation. The two were entirely distinct currents. A delicate galvanometer was controlled by the second one. A tiny beam of light was reflected by the galvanometer on a photographic plate, which was shoved along a short distance by clockwork every minute. When the professor excited the nerve by closing the first circuit, the galvanometer would swing just so far and make its record automatically. There was a series of short vertical lines, all starting from the same base line and parallel with each other. They showed by their length the exact amount of sympathetic electricity produced in the nerve. After the professor had made about ten such records, all of the same length, to show the normal effect of his excitation, he would inject some ether, chloroform or laughing gas into the tissue near the nerve. Almost immediately the amount of the sympathetic current manifested would diminish and perhaps disappear for a few minutes. The traces on the photographic plate would show this with wonderful distinctness. Different drugs produced different results. A singular thing about all this business was that when a drug had made the nerve practically insensible to an exciting current sent in one direction it would respond if the current was sent in the opposite direction. The sympathetic current would flow in the opposite direction also, and the lines produced by the beam of light on the galvanometer would be found on the opposite side of the base line. The photograph, with its two sets of projections, some upward and some downward, reminded one of the well-cleaned backbone of a fish. Prof. Walker's aim in exhibiting this work was merely to show a new method of investigation and not to reveal any new discoveries.

VITAL PROCESSES IN ANIMALS AND PLANTS.

Prof. Raphael Meldola, a London chemist, presented a paper on the above subject which attracted the attention alike of the physiologists, botanists and chemists at the meeting. It is believed by physiologists and botanists that all vital processes in animals and plants are conducted in those parts of their fabric called the cells. These processes are attended by chemical changes. The method and mechanism by which the changes are wrought are not yet known. Several investigators are studying this fascinating and important problem. Prof. Meldola is disposed to accept, as the possible explanation of the phenomena, a notion advanced by Fischer for another purpose. He thinks that the constituent atoms of the substance, which are transformed, may have a shape that is particularly favorable to combination with the protoplasm of the cell. It is a sort of geometrical idea, but not unreasonable. Within the last few years chemists have ascertained the exact composition of various dyes, perfumes and other rare and costly natural products, and have imitated nature. Prof. Meldola is not sure that man follows Nature's ways in all this work. He thinks that many compounds which man would make by combining the elementary ingredients are really the products of the disintegration of still more complicated compounds that existed previously. Such a supposition makes it necessary, of course, to believe that there was originally a building up by Nature of these complex substances, but her route and plan might have been very different from that which we now suppose.

ELECTRIC METERS.

Prof. W. E. Ayrton, of the Central Institution, in London, read a paper on this subject prepared by one of his students. From this and the ensuing comment, it appears that electric meters are subject to several influences which impair their accuracy. Mere temperature changes will affect some of them. A magnet held near others will interfere with their operations. It is possible to take current from a supply wire and store it in an accumulator without making a record, if a certain type be used, and through neglect to wind the clock in the same, there is a chance that the meter will register backward and show the supply company to be in debt

© 1897 SCIENTIFIC AMERICAN, INC.

to the consumer. The most approved forms of electric meters in England cost about $25, and there is a demand for one that will do the work as well and sell for one-third or one-quarter of that sum. Already electric meters register more accurately than gas meters, but there is much room for improvement.

VARIATIONS IN THE EARTH'S MAGNETISM.

Prof. Frank H. Bigelow, of the United States Weather Bureau, who has for several years been trying to discover how close is the correspondence between meteorological changes and certain fluctuations in the earth's magnetism, presented two papers. Certain simultaneous behavior of the magnets at widely scattered observatories suggests the possibility that the earth is immersed in what is called a magnetic field, in which there are variations of intensity and which may proceed from the sun. These variations, Prof. Bigelow says, show a tendency to fall into a typical curve. In March and September that curve stays right side up, but at the solstices it is upside down. The main object of his first paper was to explain this reversal, which he did by showing that it apparently depends on the earth's position in its path around the sun. His second paper covered a brief description of a special watch which had been made in Munich in conformity with his ideas for experimental purposes. A small magnet was suspended on the balance wheel and was apparently affected by the aforementioned changes in the intensity of the magnetic influence coming in from outer space. On some days the watch would gain one hundred seconds or two hundred seconds. On others it would lose as much. It seemed to tell the same story as the costly instruments in the special magnetic observatories. Unfortunately, the "vertical force" magnets in the Washington and Toronto observatories have recently been rendered almost worthless by the disturbing influences of adjacent trolley lines.

Our readers will find full reports, or much more complete abstracts, in current numbers of the SUPPLEMENT of all the most important papers presented at the meeting.

A CONGRESS OF PHYSICIANS.

At Montreal, last week, was held the sixty-fifth annual meeting of the British Medical Association, attended by over a thousand members and guests, including leading physicians and specialists from all parts of the United States. The association was founded in 1832, and has a collective membership of over 17,000, and Canada is the first country outside of Great Britain in which a meeting has yet been held. Dr. T. G. Roddick, president of the association, in his opening address especially welcomed the presence at the meeting of Dr. Charles Richet, professor of physiology in the University of France, and of Lord Lister, whom the president characterized as "the most illustrious surgeon of our generation, who stands for the rise and zenith of modern surgery, the most powerful agency in the development of which, in the present century, had been the introduction of antiseptic and aseptic methods of wound treatment, which he initiated."

At a subsequent meeting of the medical section, presided over by Dr. Stephen Mackenzie, of London, Dr. Wm. Osler, a professor in Johns Hopkins University, read the principal paper, tracing the development of the medical profession in America, and dividing it into three distinct periods—the time previous to 1820, from 1820 to 1860, and from 1860 to the present time. Previous to 1820, it was said, the profession here knew little else than British medicine, but after 1825 American students no longer went to Edinburgh and London, but to Paris, where a band of the noblest young men the country ever produced materially aided in promoting the signal progress of the profession. About 1860, when the energy and greatness of Virchow began to make themselves felt, the German influence on the profession here began to be strongly appreciated, especially in the treatment of several diseases, such as those of the eye, the skin, the larynx, etc., as specialties.

The section of pathology and bacteriology had for its president the well-known London surgeon Dr. W. Watson Cheyne, who said in part: "The most striking and important advance has been the growth of the great science of bacteriology, a science which has not only led to most important practical results, but has also thrown a flood of light on the processes which go on in the body as a whole, and has stimulated research in other directions not immediately associated with it. Twenty-five years ago bacteriology as a science was nonexistent. It is difficult for those who have only taken up the subject of bacteriology comparatively recently to realize the absolute blank which it presented even twenty years ago. When I became house surgeon to Lord Lister in 1876, objections of all kinds were urged against the theory on which Listerism was based, some denying the existence of bacteria at all, others maintaining the theory of spontaneous generation; some asserting that organisms were always present in the healthy tissues, others denying that they had anything to do with disease, or that the success of the antiseptic principle depended in any way on the exclusion of micro-organisms from wounds.

"It was these objections which led me to take up bacteriology, for it seemed to me of great importance to ascertain whether or not, as a result of antiseptic treatment, organisms were absent from the discharges from the wounds. Although at the present time such an investigation would be one of the simplest, yet when I came to carry it out I was met with the greatest difficulties. Practically nothing of the kind had been done before, and all the means of investigation had to be devised. Methods of staining bacteria had not been introduced, we had no oil immersion lenses, and I very soon found that by looking at discharges from wounds containing leucocytes, granular matter, and debris with dry or water immersion lenses, and without substage condensers, no satisfactory result could be arrived at. Hence I came to the conclusion that attempts must be made to see whether organisms grew in suitable fluids inoculated from the discharges. Here again everything had to be devised. A suitable pabulum, methods of sterilization, of inoculation, and of incubation had to be worked out. A large amount of time was spent in getting over the preliminary difficulties, and after a satisfactory method had been found, much labor had to be devoted to preliminary questions, such as spontaneous generation, morphological characters of bacteria, their presence or absence in the living body, conditions of growth, and so on.

"Then came Koch's work on infective diseases of wounds, and the publication of his methods of staining and examining bacteria and of cultivating them on solid media, and this work is at the foundation of all modern bacteriological research. From this period the investigations have branched off in two directions. In the first place, almost all the infective diseases have been investigated for parasitic organisms, and in a large number the causal agents have been identified. And, in the second place, researches have been carried on in the direction of tracing out the life history and functional activity of bacteria, and of ascertaining what occurs in the body when organisms or their products are introduced.

"A very remarkable thing in connection with these advances, especially in experimental pathology, is the enormous direct practical benefit which has already resulted to the human race; and it is sufficient answer to the antivivisectionists, who oppose the use of intelligence and observation and experiment, to point to the saving of human life and the relief of suffering which has taken place in the last few years. The greatest of all the advances, because so wide reaching, has been in the prophylaxis of disease, especially in the prevention of septic disease after operations, as brought about by the discoveries of Lord Lister.

"As to advances in the cure of disease, in the case of diphtheria there can be no question that the antitoxin is a most potent curative agent, and that, used in the early stages, it is almost certain to cut short the disease. As regards tetanus, the evidence in the case of animals is absolutely convincing, but in patients suffering from the disease the effect is not certain, probably because we have to do with an acute illness, which runs its course before the serum has had time to act. The same may also be the case with the antistreptococcic serum, although I have great doubts as to its value as a curative agent. In other instances, such as plague and snake bite, we may apparently look forward to a cure; while researches are being carried on with regard to pneumonia which may lead to valuable results; nor must I forget to mention Pasteur's system of inoculating cattle against anthrax. What are we to say about the new tuberculin? We all know how careful an observer Koch is, and the fact that he looks on it as a valuable remedy is to my mind sufficient to make it necessary to give it a careful and hopeful trial."

What is Electricity?

The American Electrician condenses from the London Engineering's review of Prof. Trowbridge's new book, "What is Electricity?" as follows: The writer says that in spite of the all-round progress made during the last thirty years, we know no more about the essential nature of electricity than did Benjamin Franklin 150 years ago. The several explanations offered, based upon the ether, or ether and matter associated, merely substitute one unknown for another. "After all, what is matter? What is the ether? How is matter associated with the ether? To such fundamental questions we can return no other answer than the now famous ignoramus. They make, or tend to make, us painfully conscious of the infinitude of our nescience." The writer of the review adds that Lord Kelvin must have been brooding over these provoking unknowns when he wrote to him in 1892, "Tell me what electricity is, and I'll tell you all the rest." This inability to detect electricity in its primordial form need, however, exert no distrustful, no depressing effects on the mind of the student of physical science. "Let him remember that a ray of light is an unexplained phenomenon; yet what wonderful truths are revealed to Fresnel, what knowledge has been wrested from it by means of the spectroscope, and what marvels is it not every day recording on photographic plates! If he feels himself morosely affected by this agnosticism, let him recall the astronomical phenomena which are accurately calculated years in advance without any knowledge whatever of the nature of gravitation; or let him think of that masterly bit of analysis which led to the discovery of argon without any knowledge on the part of Lord Rayleigh or Prof. Ramsay of what chemical affinity is. If he is a practical man, let him reflect that the engineer lives amid stresses and strains, and though ignoring the intimate nature of the forces which he uses, builds up powerful engines and dynamos, and as successfully tunnels a Mont Cénis as he throws a bridge across the Hudson or the Firth of Forth."

Photographic Energy of the Light of Fire Flies.

A very interesting investigation of the luminous and other radiations emitted by fire flies has just been published in the ninth volume of the Journal of the College of Science, Imperial University, Tokyo, Japan, says the Lancet. The author, Mr. H. Muraoka, who writes in German, is professor of physics at Kyoto. He mentions that the spectacle produced by the fire flies about the middle of June is one of the sights of the place, and he states that the present inquiry was suggested to him by the resemblance of their light to that of fluorescent bodies, some of which have been shown by H. Becquerel to emit radiations possessing properties analogous to those of the Roentgen rays. The flies are most luminous from about 6 P. M. to 11 P. M. The experiments were made by placing a number of them, varying from three hundred to upward of one thousand, in a small flat box in which they were confined under a net made of hemp ("deren Wegfliegen mit einem Hanfnetz verhindert wurde"). The box also contained a photographic dry plate, in contact with which were plates of various metals (copper, aluminum, zinc and brass), all of similar thickness, sheets of cardboard, both entire and also with cruciform patterns cut out of them, being sometimes interposed between the sensitive plate and the metal and sometimes used alone with the sensitive plate. Thin wooden boards were also employed for the same purpose. The sensitive plate and the objects in contact with it were wrapped in several thicknesses of black paper and left in the box with the flies for two nights. The experiments were made in a photographic dark room, sunlight and artificial light being carefully excluded. The sensitive plates, though thus wrapped up, and additionally protected by metallic plates and layers of cardboard, gutta percha, cloth, silk, etc., were always more or less blackened.

Prof. Muraoka makes frequent reference to papers published in Nature in the early part of 1896 by Dr. John Macintyre, of Glasgow, and Mr. J. J. Thomson. His experiments led him to the following conclusions: 1. The light of the flies in its original state behaves like ordinary light. 2. The light contains rays which pass through cardboard, metal plates, etc., and possesses properties analogous to those of Roentgen rays or Becquerel's fluorescent rays. 3. When the photographic plate is covered with layers of cardboard, it presents an appearance which calls to mind the permeability of iron to magnetic lines of force. 4. The properties of these "filtered" rays appear to be influenced by the materials through which they have passed, perhaps by the thickness of the materials. 5. The properties possessed by the radiations and specified under No. 2 are apparently non-existent, or at least undiscoverable until after "filtration." The Roentgen rays are similarly undiscoverable until after "filtration"—i. e., through the glass of the Crookes tube—and "filtration" may, perhaps, afford a means of rendering the X rays homogeneous. 6. The "filtered" fire fly rays undoubtedly admit of reflection. Refraction, interference, and polarization could not be demonstrated, but Prof. Muraoka is of opinion that they take place. 7. The "filtered" fire fly rays seem to resemble Becquerel's fluorescent rays in possessing properties intermediate between the ultra-violet rays and the Roentgen rays.

The Boston Subway Open.

A part of the subway, Boston's new underground thoroughfare for street cars, was open to public traffic the morning of September 1. The sections to be operated for the present are about three-quarters of a mile long; other sections will probably be opened in the spring. The trip from the public garden entrance to Park Street was made in a little over four minutes; 100,000 people rode through the subway the day that it was opened. The contract for building the last section near the Union Station has been awarded and the work started. The transit commissioners believe that before next summer the entire subway will be in use and Tremont Street wholly free from cars.

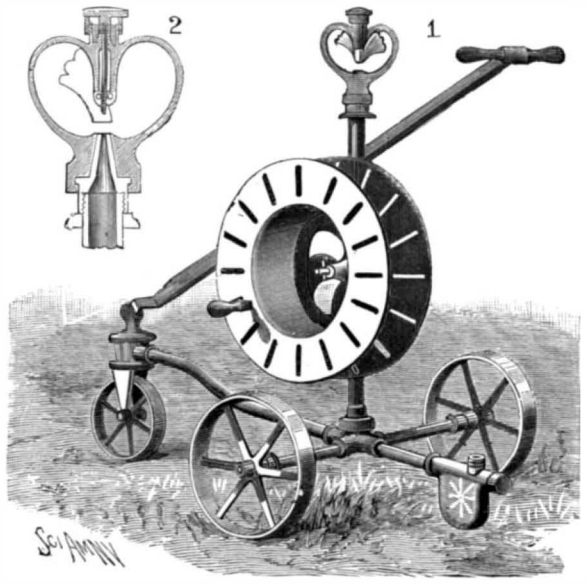
Ground Broken for a Railway in China.

A dispatch from Vladivostock, dated August 30, says that the first sod in the work of construction of the Chinese Eastern Railroad was cut in Chinese territory, near Stanitzapoltavskaya, on that date. A number of Chinese authorities were present.

© 1897 SCIENTIFIC AMERICAN, INC.

AN IMPROVED LAWN SPRINKLER.

The sprinkler shown in the illustration may, with its attached hose reel, be conveniently moved about as desired, and is designed to properly and uniformly sprinkle a large area of ground at one time. It has been patented by Enoch A. White, of Hailey, Idaho. Fig. 1 shows the sprinkler complete, and Fig. 2 is a sectional view of the sprinkling head. The carriage frame

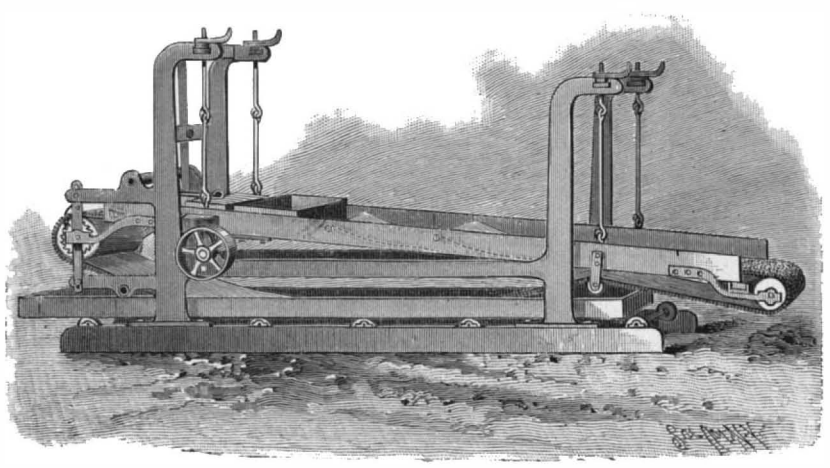


WHITE'S LAWN SPRINKLER.

is formed with a five-way casting, two transverse tubes therefrom supporting at their closed ends the main axles, while the rearwardly extending supply tube has near its outer end a trap, and a top and end nipple, to either of which the hose may be attached, a forwardly extending tube supporting at its closed end the steering head, the fork of the steering wheel being connected with a handle. The top of the five-way casting is connected by a ball and socket joint with a stand pipe, at whose upper end is a nozzle discharging on one or more propeller blades on the lower end of a pin turning in a central ball bearing or socket, formed in a yoke or bow, which turns by a coupling on the nozzle. The top of the bearing is closed by a cap, and in the top and around the body of the pin, as shown in Fig. 2, are spaces for lubricating oil. The water discharged from the nozzle rotates the propeller blades, and also causes the yoke to revolve at a comparatively low speed. As the water passes from the trap to the sprinkler, it enters the tubes extending horizontally from the central casting and compresses the air therein, which is thus made to act as a cushion and governor, and by means of the trap or seal the water is retained in the stand pipe after the supply is shut off, the seal acting as a check valve on the water in the sprinkler. On the stand pipe is a collar held in place by a set screw, and the collar carries a stud on which the hose reel is journaled.

A CONCENTRATOR FOR PLACER MINING OR STAMP MILL PRODUCTS.

The concentrator represented in the accompanying illustration is designed to facilitate the separation of the valuable particles of precious metals from the lighter materials and gangue, in the treatment of placer mining and stamp mill material. It has been patented by William M. Moore, of Empire, Col. On a suitable base is a framework from which a table is suspended by links at an adjustable inclination, the under side of the table near its upper end being adapted for engagement by a cam on a transverse shaft, imparting motion to the table in one direction, while a quick opposite movement is given to it by a spring whose tension may be increased or diminished, the



MOORE'S CONCENTRATOR.

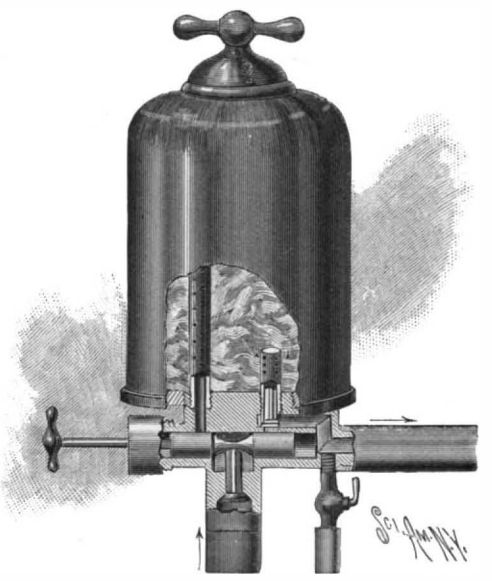
return movement being interrupted by projections which abut against fixed parts of the framework. Over the table, and between its side flanges, a belt with a heavy pile on one face, such as a carpet, travels intermittently over rollers journaled at each end of the table, the lower run of the belt passing through and depositing the concentrates in a wash box removably supported on rollers journaled in the base of the machine. The material to be treated is fed to a receptacle having a perforated bottom secured to the top of the table, so that it readily passes through onto the belt; and across the upper end of the table is a perforated pipe from which issues a spray designed to wash the lighter materials and gangue down the belt, against the direction of movement of the latter, while the valuable particles settle in the pile of the belt and are carried by it over the pulley down to the wash box. Previous to entering the water in the wash box, the spray from another perforated pipe is directed upward against the pile of the belt fabric to assist in washing out the particles. To further prevent the passing down of valuable particles, two aprons of similar fabric to that of the belt, and with the pile on their under side, are attached to the side flanges of the table, the contact of the piles of the two fabrics being designed to loosen the particles being washed down on the belt, and cause them to more readily settle in the pile of the upwardly moving belt. The water and other material passing through to the bottom of the table is discharged from a transverse trough at its lower end, the gangue carried down being dumped over on the ground.

Panama Canal's Condition.

The British consular officers at Panama and Santa Martha describe in their last reports the present condition of the work on the canal across the isthmus and of the railway connecting the Atlantic with the Pacific. The New Canal Company, formed in Paris in 1894, to continue and complete a ten lock canal rising to a maximum altitude of 133 feet 8 inches, in place of the original sea level scheme of M. De Lesseps, has made good progress with the small capital at its disposal, and the reduced canal trough, or cunette, in the Emperador and Culebra sections is now assuming definite proportions. Although the end in view was the final completion of the canal, it could hardly have been supposed that this great undertaking could have terminated and the canal be opened for maritime traffic with only £2,500,000, of which only about half was to be spent on the canal proper. The work is of a purely experimental character, in order to demonstrate that a lock canal is feasible. It consists of a watercourse 98½ feet wide at the surface, with half that width of bed. About £60,000,000 have been raised since the inception of the scheme, sixteen years ago, for the purpose of the canal, and have been spent in one way or another.—The London Times.

AN APPARATUS FOR CLEANING PIPES.

The illustration represents a pipe cleaner with which the operator may at will send through the pipes a solution of a suitable chemical, such as sal soda, or a stream of pure water, the arrangement of parts being such that the apparatus will be held in closed or inactive position by the pressure of the water, while it may be readily adjusted by the operator to the several positions used in practice. The improvement has been patented by Peter F. Gaynor, of No. 18 William Street, Albany, N. Y. As shown in the engraving, the apparatus is adjusted to close the water inlet, indicated by the arrow at the side of the lower vertical pipe, and above is a bell-shaped receptacle having in its top a screw plug to afford ready access to the interior when required. In the receptacle is an inlet port and an outlet port, both formed in the valve casing, there being over the inlet port a perforated tube and above the outlet port a shorter perforated tube, the latter connected by a channel to a discharge passage, a port from this channel leading to the longitudinal bore of the casing, and being controlled by a piston valve whose stem passes through a stuffing box and terminates in an operating handle. The main inlet port is controlled by an inwardly seating check valve, this port being adapted for connection with a tube or hose through which water is supplied, and a nipple adjacent to the outlet, at the end of the valve casing, is adapted to receive a hose leading to the pipes to be cleaned. In the outlet port of the receptacle is also a valve which may close the port leading to the longitudinal bore of the casing, and this bore at its outer end connects with a cock whereby compressed air may, if desired, be admitted into the apparatus. The piston valve, as will be seen, has a section of reduced diameter, forming a seat for the check valve, which is held against its seat by the pressure in the supply hose, thus practically locking the piston valve. The desired chemical solution having been placed in the receptacle, and the outlet end connected by a hose with the pipes to be cleaned, the operator pulls the piston valve out, thus unseating the check valve and admitting water through the casing and through one of the perforated tubes into the receptacle, as indicated by the arrows, the water taking up some of the chemicals and passing out through the other tube, and the outlet channel and hose, to the pipes to be cleaned. When the piston valve is moved inward to its limit in the other direction, the water passes directly through from the inlet port to the hose, without passing through the receptacle, thus removing the chemical solution and washing out the pipes. The water may now be expelled from the pipes by opening

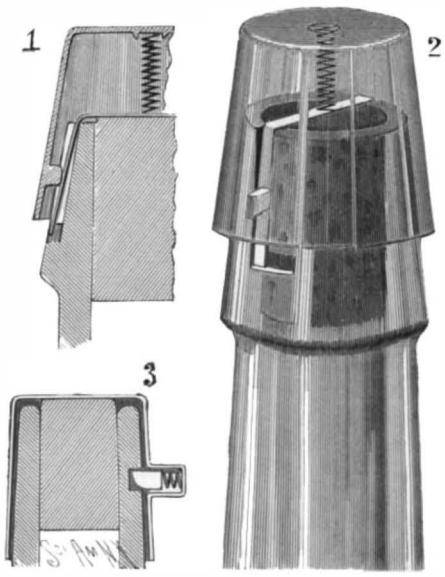


GAYNOR'S BEER PIPE CLEANER.

the cock connecting the valve casing with the compressed air pipe, in which connection it may be mentioned that the air hose itself may be cleaned in the same manner as the beer pipes are cleaned.

A NON-REFILLABLE BOTTLE.

A bottle which, after having once been sealed, cannot be opened to remove some of its contents and again refilled to represent an original package, is shown in the accompanying illustration, and has been patented by James H. Springfield, of Platteville, Col. Fig. 2 represents the bottle with the stopper partially applied, Fig. 1 being the same view in section, and Fig. 3 showing a modified form of the device. The bottle neck has opposite L-shaped slots on its outer face, in the vertical portions of which extend the terminal members of a yoke whose bow member extends over the cork, across the top or mouth of the bottle neck. A cap, preferably of glass or other frangible material, is then placed in position as shown, the cap having in its opposite sides



SPRINGFIELD'S NON-REFILLABLE BOTTLE.

lugs which press inward the terminal members of the yoke, the cap being thus moved downward until its lugs may be made to enter the horizontal members of the L-shaped slots on the exterior of the bottle neck. A spring has a bearing on the top of the yoke and against the upper face of the cap, and the pendent members of the yoke, being of spring material, fly outward when the cap is fully applied, forming locks preventing the backward turning of the cap, so that the cap must be broken or destroyed before the contents of the bottle can be poured out. As shown in Fig. 3, a recess is made instead of the slots in the bottle neck, and the cap has in one of its sides a tubular offset containing a pawl and a spring, enabling the cap to be readily placed in position over a cork, but preventing its removal except by breaking, as in the former case.

The Paris Bazar Fire.

The operators of the cinematograph were declared responsible for the fire and sentenced respectively to one year in prison and 300 francs fine and eight months' imprisonment and a fine of 200 francs, Baron Mackau, who was one of the principal promoters of the bazar, was found guilty of "imprudence," and was sentenced to pay a fine of 500 francs.

© 1897 SCIENTIFIC AMERICAN, INC.

HOW TO BUILD A SMALL ALTERNATING CURRENT DYNAMO WITHOUT CASTINGS.

(Continued from first page.)

together, which would throw the alternator in danger. The writer recently had charge of an insulator testing plant with alternator and transformers in combination, giving a voltage at times as high as 50,000. While the alternator laid down in the following description is rather small for very high voltage, it will be found very

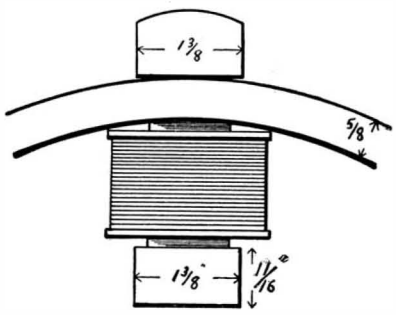


Fig. 3.

convenient for illustrating principles, and if successfully built, one twice the size will be all that is required to furnish light and power for commercial purposes.

THE RING AND FIELD MAGNETS.

It would perhaps be wise for the beginner to construct the machine according to the directions and dimensions laid down before undertaking to build one on a much larger scale. The size of the largest generator it is feasible to put together on this system is somewhat limited by the largest bolts with the proper heads, and the heaviest and widest tire it is possible to bend with rollers, but it will be seen that a powerful and useful dynamo can be quickly built on this plan and at a reasonable cost. For experimentation with armature cores and windings, the ten inch ring machine will be of great assistance. Let us begin by forming the iron ring and mounting the field magnets.

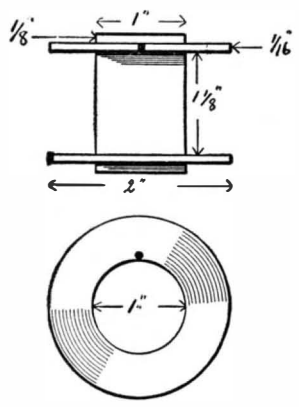


Fig. 4.

This ring should be about 5/8 inch thick and 2 3/8 inches wide, with an internal diameter of 10 inches. It can be started by using tire benders, but, owing to its small diameter, it must be helped out, so to speak, by manipulation on the mandrel and afterward welded. After hammering the ring as near a perfect circle as possible, it should be chucked on the lathe and turned perfectly true outside and inside as well as on the edges. The ring should now be carefully marked off in ten equal divisions and holes drilled radially on each mark to receive the iron bolts. Each bolt must measure 3 1/2 inches in length from the face of the bolt head to the top of the screw. The holes must be just large enough to allow the bolts to be hammered in through the ring, as a tight fit is very desirable. By referring to Fig. 3 the size of the bolt head can be seen. If the head of

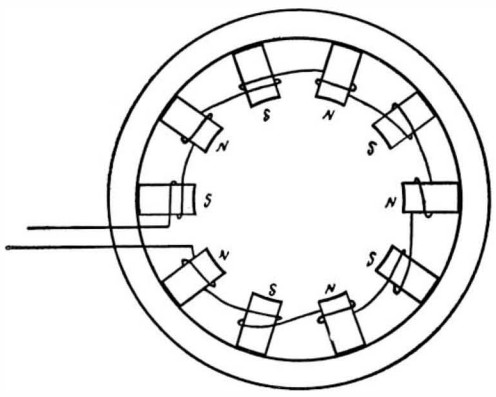


Fig. 5.

the bolt were larger the field would not be as efficient, as magnetic lines of force would leak too freely from pole to pole, instead of making the circuit through the armature core.

Having secured the bolts and drilled the holes to receive them, the next operation is the making of the magnet spools. These must be made from brass, as they are to answer the double purpose of holding the magnet wire and of taking up the pressure when the screws are firmly turned in place on the bolts. The dimensions of the spools are clearly shown in Fig. 4. Brass disks 2 inches in diameter are mounted and soldered on to pieces of brass tube 1 1/2 inches long, leaving 1/8 inch top and bottom to take the pressure off the wire and ends of the bobbin when the whole is clamped firmly in place. This space between the head of the bobbin and the head of the bolt also allows the wire to come through and make connection with the next without having the insulation crushed. These disks, which form the ends of the bobbin or spool, can be turned five or ten at a time on the lathe by soldering together at the edges the required number of square pieces of brass and chucking in the lathe in order to cut the one inch hole through the center. Of course, after the hole is made the disks are mounted on a lathe mandrel and the corners and solder turned down until the disks measure 2 inches in diameter. Having made the ten brass bobbins, they should be given five or six coats of shellac, after small holes have been drilled in the disks to carry the wire out of the bobbin. Each coat of shellac should be allowed to harden before the next coat is applied, and the smallest size of rubber tubing should protect the wire where it passes through the hole. The spools should be slipped over the bolts to see that they go up well against the head. Should any of them stick before they go all the way on, the bobbin should be chucked in the lathe and one end of the tube quickly reamed out until the bobbin will easily slip up as far as the end of the bolt head. Of course, the best way to wind the bobbins is to chuck them in the lathe. Here a choice of wire is to be made. Each bolt must be wound so it can readily be made a powerful magnet without requiring a very great current strength. To powerfully magnetize one of the iron bolts used in the alternator 600 ampere turns will be required. We may get the required number of magnetic lines of force in our bolts by using any of the following windings and currents. If we wind each bolt with 50 turns and employ a current of 12 amperes, it will amount to 600 ampere turns, as well as the following: Six amperes and 100 turns; 3 amperes and 200 turns. As we expect to use our dynamo in connection with a fan motor for medical purposes, it would be well to select a winding that would be the most economical when connected through lamps to a 110 volt service. We will go still farther and wind each bolt with 300 turns of wire, requiring only 1 1/2 amperes to bring the field up to a powerful state of excitation. With this winding, when the generator is to be used in medical treatment only, 1/2 ampere will be required to send around the field. Each spool will hold 300 turns of No. 20 double cotton covered magnet wire, if the wire is carefully and neatly wound on. This size of wire will go on the bobbins in 12 layers and measure 120 feet for each spool, 1,200 feet for the ten. The voltage generated in the armature will vary with a constant strength of field, with the speed at which the generator is driven giving another method for regulation. For medical treatment currents of varying character may be had by using the dynamo as follows: First, by giving the fields strong excitation and driving the machine at a low rate of speed. This will give ample voltage and current, but at a low frequency of alternations. Secondly, the fields can be only very feebly excited and the machine driven at the highest speed possible with the motor at hand. This will give the required voltage and current also, but the frequency will be extremely high. Never take the current when the fields are strongly excited and the machine is being driven at a high rate of speed, too, for this current and voltage is only intended for lighting and experimental purposes.

Having wound and mounted the field bobbins and screwed the field bolts firmly in place, the free ends of the wire should be joined by means of small brass screw sleeves known as connectors. The ends must be connected up so the current will go around one spool in one direction and around its neighbor in the reverse, in order to get north and south poles. By referring to Fig. 5 the idea will be understood. Having connected according to the diagram the polarity should in all cases be tested by exploring the field with a compass needle, to make perfectly sure the poles alternate in polarity all the way around the ring. Should this connecting be neglected, no alternating current will result. In testing the fields with the compass needle, the fields had better be excited with a battery, if at hand; otherwise the spools can be connected to the 110 volt mains, but in each and every case with a 110 volt lamp in series with the field. Should the field winding ever be connected directly with the 110 volt circuit, an accident would surely result. The fuses in the building should blow out, but, in case they failed, the wire on our machine would have to blow out instead. The ring should now be mounted on its base board. This had better be made from oak and be one-half inch thick. Figs. 1 and 2 show the method of making feet for the base, by using bolts and nuts like the ones used on the fields. Heavy pieces of iron should be bolted across the grain on the bottom of the base board to prevent it from warping or buckling in any way, as well as to add weight to the base. The base measures 8 by 12 inches. One of the bolts, namely, the bottom one in the ring, is substituted for a longer one, capable of going through bobbin, ring, and base board, carrying an iron washer and having its bolt head screwed on firmly.

It will be noticed how conveniently the two adjacent bolt nuts come in position against the oak base, being forced in the wood a little way, when the lower bolt is

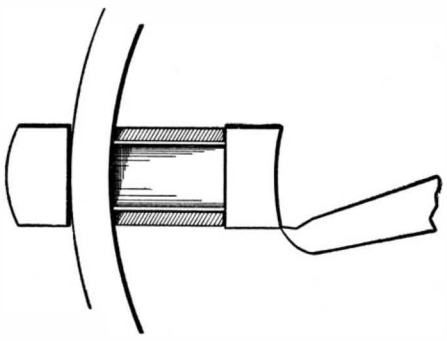


Fig. 6.

strongly turned with a wrench. These serve to keep the dynamo straight on the base and prevent wabbling or turning. Brass binding posts must now be mounted on the base and connected with the two free ends of the field winding, a second pair being mounted on the base in front to be connected to the brush holders, collector rings, and armature. Before painting the ring and bolts, the ring must have four holes drilled through the edge to receive the bolts which carry the bearing cross pieces, brushes, armature, etc. These holes must be most carefully marked off, for the bearings, when mounted, must be exactly in the center of the ring and pole pieces, or else it is very evident that the armature will not revolve freely, but collide with the pole pieces.

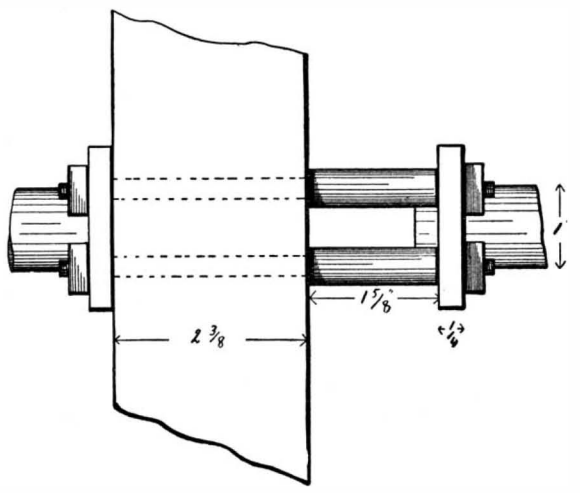


Fig. 7.

To lay off the marks for these important holes, the ring should be marked off exactly in half, by measuring with mechanic's dividers. Having proved that you have found the exact center of the ring, by the most careful measurements, a tiny hole should be made to mark the place, a similar hole marking the spot on the opposite side of the ring on the same surface. The four holes which are to carry the bolts go through the ring on each side of the marks exactly one-half inch from them, top and bottom. In drilling these holes do not attempt to drill all the way through from one side, but reverse the ring and carefully carry the marks around to the other side and go through and meet the partially completed hole. Should this not be done, the

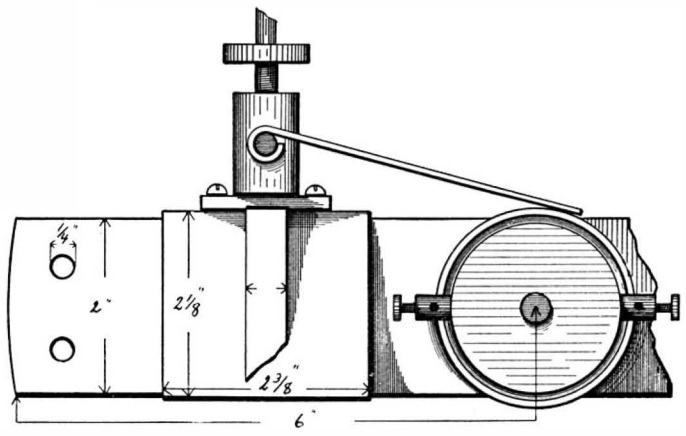


Fig. 8.

drill will surely travel a little out of the line intended for it, and trouble will surely result. The ring and bolts will have a good appearance if painted with black bicycle enamel, looking very well in combination with the brass trimmings. The base board should be given four or five coats of orange shellac, applying it top as well as bottom, in order to keep out all dampness and prevent warping tendency. The bolt heads can to advantage be cut out a little on the lathe as illustrated in Fig. 6. This will add to the efficiency of the generator for lighting and experimental purposes but is not abso-

© 1897 SCIENTIFIC AMERICAN, INC.

lutely necessary for medical purposes. Should a larger machine be constructed, the writer would advise the cutting out as shown. As will be readily seen, the iron bolt is passed through a piece of heavy iron pipe the exact length of the brass tube in the bobbin. The iron pipe should be as large as possible, in order to better take up the heavy strain due to the tool cutting in the lathe. They had perhaps better be all cut at the same time, using ten pieces of the pipe slipped on in the place of the bobbins. The armature described in this connection is intended for the simple smooth bolt heads, and must be cut a trifle larger than the one in the diagram if the bolt heads are to be cut out in the lathe. In cutting the bolt heads it will be evident to every mechanic that light cuts must be made, in view of the manner the work is held. Be sure each bolt head is turned perfectly square before cutting out, or

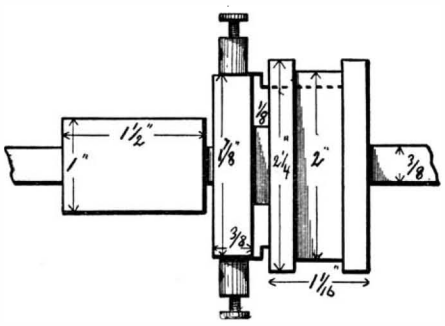


Fig. 9.

the resulting curved cut will be everything but attractive in appearance.

THE BEARINGS AND COLLECTOR RINGS.

The machine is now ready for the bearings, the cross pieces which support them and the collector rings. Figs. 7 and 8 show the dimensions and enlarged portions of the bearing supports. Bolts 5½ inches long are driven through the holes in the ring, leaving just enough room on the back to go through the rear bearing plate, so it may be bolted securely in place. Four brass tubes carefully cut to measure 1⅝ inches are put on the bolts in front and the second bearing support firmly clamped against them. Fig. 7 shows plainly the principle. The bearings are to be next made from solid brass rod and bored through on the lathe. Brass rod one inch in diameter is cut in two pieces 2½ inches long each and a ⅜ inch hole bored through on the lathe. The bearing plates are now taken off and placed in the lathe, in order to cut an inch hole through to receive the bearing. The bearings are to be soldered or brazed to the plates. As it is of utmost importance that the bearings should be "in line," they must not be soldered to the plates until the shaft is put through, throwing the bearings in perfect line. Should this be overlooked and the soldering or brazing be done, the chances are that the shaft would not go through the bearings at all, or else turn with a cutting and binding resistance. Having mounted the bearings to satisfaction, they can be bored through on top in order to receive small brass oil cups, which come ready made of just the size required. They can be screwed right on the bearing and are as useful as ornamental. The wooden hub which supports the collecting rings can now be made and is illustrated in Fig. 9. It is best turned from hard wood, and. being of the form shown, enables one to readily detach the armature from the shaft.

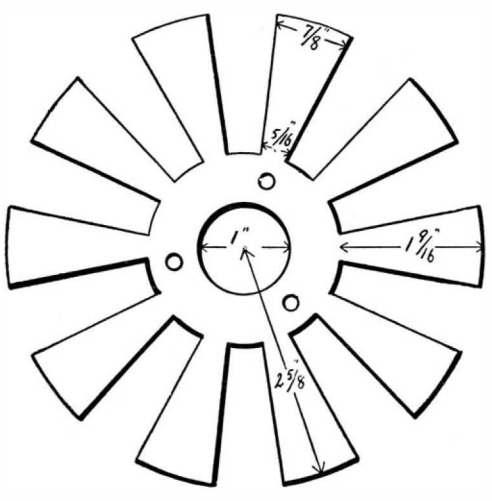


Fig. 10.

The sliding rings are easily made by sawing off the end of a piece of large seamless brass or copper tubing. The rings are smoothed down with a file and driven on each side of the hub, which must be turned on the lathe to receive them and make a good, tight fit. The binding posts are screwed in the flange turned for the purpose and are connected to the rings as illustrated. The wires had better be soldered to the rings as well as to the binding posts, to insure a perfect electrical contact and prevent their working loose when the armature is driven at the high speed of two thousand revolutions per minute. The hub shown on the extreme left of the shaft is of brass and is designed to carry the armature. The shaft is to be cut from a piece of ⅜ inch steel machine shafting. The brass and wooden hubs should go tightly on the shaft, using a mallet if necessary to drive the shaft through. Small washers will in all probability be found necessary, as no lateral movement of the shaft, armature and collector rings is desirable. The front bearing plate is now ready to be drilled to receive the little screws which support the blocks which mount the brushes and their supports. The dimension and position of the blocks is clearly shown in Fig. 8. They should be about an inch thick and have several coats of orange shellac. The brush holders are easily made from large binding posts and heavy brass wire bent at right angles where the end goes through the binding post. With a combination of a binding post and heavy wire bent as illustrated, a varying pressure of the brushes on the collector rings can be had by simply moving the long arm of the wire back and forth, or the brushes may be raised from the rings altogether, which is a very desirable thing. The connection between the brush posts and the binding posts on the front of the base is best made by using copper ribbon about ½ inch in width. The ribbon is cut and soldered together again at right angles when a change in direction is necessary. The use of copper ribbon gives a much neater appearance to the generator than connections of wire, and is to be seen on most fine dynamos. A pulley can now be turned from hard wood and have a diameter of about 2 inches and be about 2 inches in length. A couple of layers of lineman's insulating tape wound around the pulley in even layers makes the most excellent surface for the belt to run on, as there is the proper friction for the belt, and the cushion formed adds to the machine's easy and noiseless running. The brass work, if polished with the finest emery cloth, had better be protected with lacquer if the machine is to be ornamental as well as useful. Little handles of hard wood are to be turned to go on the long end of the brush rockers and be lacquered. This brings the machine to the armature, and another choice in type or construction presents itself.

THE ARMATURE.

Either a ring or toothed armature will give good results with the field just built, if only very thin soft iron is allowed to enter into the construction. The author will give only one type of armature completely worked out, and has selected the tooth type because, on the whole, it will be found the easiest to make, and prove, perhaps, a little more efficient, because the grade of Russia iron that comes in sheets is softer than the band iron used in the construction of the ring type of armature. If, after completing the toothed armature, the builder cares to experiment with a ring type, no great difficulty will be met, if band iron is procurable that has not been bent every few feet, as this seems to be the custom in packing band iron for shipment, etc. If the iron cannot be had without these sharp bends, it can be hammered out fairly well and made to answer the purpose. The band iron should be about one inch wide and as thin as possible. A wooden block should be turned in the lathe to form a drum to wind the iron on and be such a size that the iron, when wound on about ⅝ inch thick, will revolve in the field, clearing the pole pieces by ⅛ inch. The iron should be bound with small iron wire and, after giving a coat of shellac, be wound with insulation tape. The ring must be wound with ten coils of wire equidistant, each coil having a reverse direction from its neighbor. One drawback in making an armature of this type is the mounting of it on the shaft, but this can be accomplished fairly well for experimental purposes by using a turned wooden hub and mounting that. By referring to Fig. 10 the toothed type of armature can be seen. The core for this armature is made by cutting out single pieces from the thinnest Russia iron, about 60 sheets to the inch. Thirty pieces will be all we require for the present type. Copy the diagram exactly by cutting with tinner's shears, all but the center hole, which is cut afterward on the lathe. Cut out the first toothed disk very carefully, for this is to be the guiding pattern for the rest. An easy method of getting out the remainder of the disks is as follows: Cut 30 small pieces, preferably squares, from the sheet iron just large enough to make one disk, and put one disk at a time in the screw vise under the carefully cut iron pattern. It will be found a very easy method if a good sharp pair of tinner's shears are to be had. The chief care necessary is in turning the pattern and half cut blank around in the vise in order to get at the rest of the teeth. If the different disks are laid on top of each other as they were cut, no difficulty in making a smooth and symmetrical armature core will be met. That is to say, a tooth on a disk, cut from a given tooth on the pattern, should be laid on its neighbor's which was also cut from the same tooth on the pattern. This is important and must not be overlooked. The core is now ready to receive shellac. Each disk must have a coat, and a piece of tissue paper pressed on before it has become hard, before the disks are permanently put together. Two iron washers must be placed on each side of the core to act as cheeks and stiffen the pack of disks when the whole is bolted together. Fig. 11 shows one of the iron washers in place. Having placed the disks and washers as evenly as possible, they should be firmly clamped in an iron machinist's vise and the holes for the bolts put through. After bolting together and screwing up as tightly as possible, the core must again be placed in the vise and all unevenness smoothed down with a flat file. The core is now ready to have the hole cut through the center by chucking the core by the ends of the teeth in the lathe. The core must be perfectly centered, and all usual centering tests must be made before a

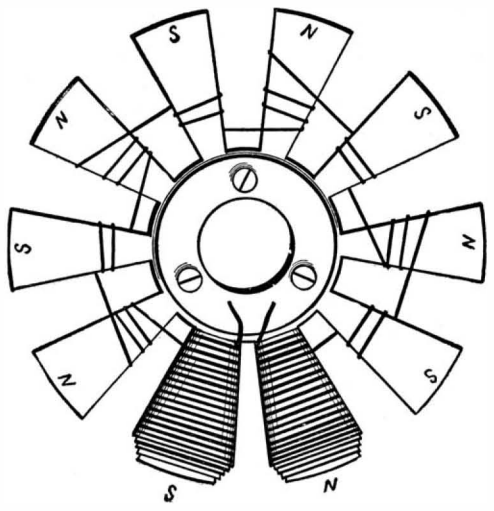


Fig. 11.

single cut in the center is made. Use a sharp tool and cut out a one inch hole through the cheeks and disks.

The core must now be mounted on a lathe mandrel and the edges of the iron washers turned up true. The ends of the teeth are too thin to stand the strain of cutting or truing in the lathe, and must be carefully made of equal length by filing with a flat and fine file. The armature should not be cut away on the teeth any more than possible, as the nearer the ends of the teeth approach the field poles, the more efficient will be the machine. A keyway is made in the brass hub by chucking in a metal planer, if possible to have the use of one. The keyway in the hub to receive the locking key is easily made with the file. The core is now given five or six coats of shellac, each coat being allowed to thoroughly harden before the next coat is applied. This is a matter of extreme importance, as a poorly insulated armature is worse than none at all. Just before the last coat of shellac becomes set, each tooth of the core is covered with heavy pieces of cotton or silk remnants. This is also very necessary in order to keep the insulation of the wire away from the sharp turn made at the edge of each tooth. This silk covering is given a final coat of shellac before the operation of winding on the wire begins. Wind on the wire carefully and neatly as follows: Commencing from the bottom of any tooth on the core, wind No. 22 double cotton wrapped magnet wire on in four even layers. Each layer must be closely wound and a coat of shellac applied between each layer. Having completed one tooth, its neighbor must be wound in the reverse direction as illustrated in Fig. 11. No bobbins or spools are necessary to hold the wire on this core, as the shellac, after hardening, is all that is necessary to keep everything in place. The shape of the teeth, in addition, tends to keep the wire

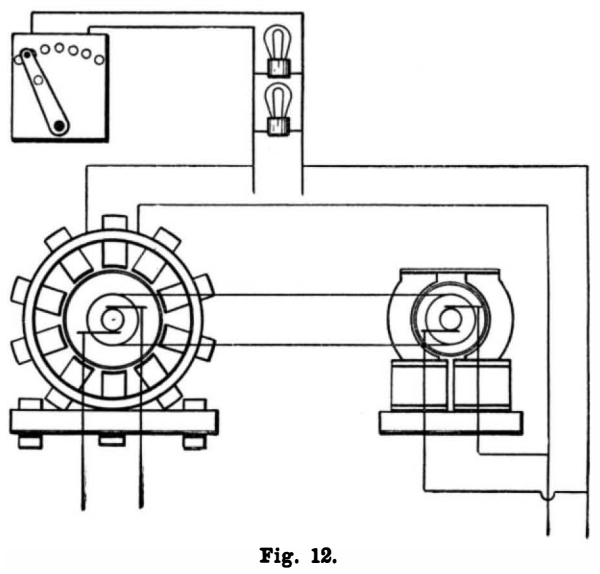


Fig. 12.

in place, and will prevent its flying off when under the centrifugal strain. Each layer on a given tooth is a trifle shorter than the one under it. The reason is obvious, not to speak of the neat appearance it gives. When the winding is completed, give the whole three or four coats of shellac and do not test the armature under high speed until the shellac has become perfectly hard in every sense of the term. The author had the misfortune to try the armature when the shellac was nearly hard, and, on stopping the machine, found long needles of shellac that had made their way to the surface oozing out in all directions. This armature when in condition to run without disturbing the shellac

© 1897 SCIENTIFIC AMERICAN, INC.

will be found efficient for lighting lamps and for furnishing a delightfully even and, if one may say, smooth current for the treatment of patients. It is hardly necessary to point out the connections between the two free ends of the armature and the collector rings before going to the method of connecting the generator to the electric lighting mains. Fig. 12 illustrates the plan of connections. As each lamp is added between the mains the field of the generator becomes more strongly magnetic. For some cases where the machine is desired for medical use the current delivered when one lamp is in circuit will be too strong. This represents a current strength of about one-half ampere going around the fields. If two lamps are put in series across the mains and connected with the fields, a much weaker current will be delivered from the machine. If a rheostat is introduced into the field circuit having a greater resistance than several lamps as a maximum, the current from the generator can be regulated to a nicety. There is absolutely no danger of the current from the electric lighting circuit getting into the armature of the generator and doing any damage to patients, but it must be remembered that the generator just completed is capable of shaking one up just as effectually as the main line, if a strong field and a high speed are put in combination.

Honey and Bee Keeping.

BY GEORGE E. WALSH.

Half a century ago honey was considered a luxury, and the market was supplied by the professional bee hunters, who made a precarious living in locating the natural hives of the bees in some old rotten tree right in the midst of the thick forest; but to-day, 30,000 bee keepers vie with each other to supply us with all the varieties of delicious honey that we are willing to pay for, and at prices within the reach of every one. To the average consumer, probably, there seems to be no difference in the honey that comes to the market, but, if he should enter a large grocery store and examine the stock, he would find that modern beekeepers have created just as many grades and kinds of honey as the pomologist has produced varieties of apples or pears. There is, first, the great division between comb honey and extracted honey; then comes white clover honey and buckwheat honey, one dark and the other light in color; and between these two extremes in color come half a dozen intermediate shades. Another distinction is made in the relative thickness and specific gravity of the honey. One variety will be light and thin, while another will be thick and heavy as old molasses. Some of the honey is labeled as fruit blossom honey, another class will be honey made from basswood and linden blossoms, and other varieties as early spring honey, summer honey, late fall honey, diluted honey and pure strained honey. In this classification of honey there is an attempt to separate honey made at certain seasons of the year from that made later or earlier, and also to keep the honey made largely from one kind of blossoms from all other grades. It is a notorious fact that buckwheat blossoms do not make as fine, delicate and aromatic honey as the white clover blossoms, and some consider the honey produced from the fruit blossoms of early spring superior to that of white clover. Of course, men of many tastes will differ, and probably there will never be a time when all will agree upon the best variety of honey.

Bee keeping has become an interesting and extensive business in this country, and in the spring and summer of the year there is widespread activity among these professional apiarists. California leads all the other States in the number of its bee keepers and in the quantity of honey raised for market; but many of our Northern States follow close behind her. The South is just awakening to the advantages of her climate and products for bee keeping. Florida sends a fair amount of honey to market, but it does not equal in quality or quantity the honey that is raised in the North or on the Pacific coast.

In our Northern States the bees gather most of their nectar from the white clover blossoms, the basswood tree, goldenrod, fruit blossoms and buckwheat. In California the fruit blossoms, wild flowers, white sage, sumac blossoms and alfalfa clover supply the bees with most of their sweets. In the great middle West the sage brush furnishes limitless food for the bees and makes bee keeping profitable.

In regions where bee keeping is being overdone, the apiarists even plant crops for their colonies to live on, and it is not unusual to see farmers raising fifty acres of white clover in the spring and buckwheat in the fall to supply their bees with nectar, the crop of grass, hay and grain being only an incidental feature of the harvest. Fruit growing and bee keeping go together so well that most apiarists are now planting fruit orchards on their bee farms, and, in seasons when one fails, the other is pretty sure to yield some profit.

The bees have luxurious quarters to-day compared with those of twenty years ago, and the bee keeper, by means of modern improvements, can handle more colonies successfully and obtain more honey from each one than the pioneers in the industry ever dreamed of. In 1852 a clergyman named Langstroth, living in a small town in Ohio, invented and patented a hive which revolutionized bee keeping. The hive, after all, was quite simple, and it seemed strange that nobody had hit upon the idea before. It consisted of a square box with eight movable frames inside and a movable cover on top. By means of this patent hive the apiarist could look in and see what the bees were doing any time, and the whole thing could be easily taken apart and cleaned. Then somebody invented an artificial comb. It usually took the bees about half the honey-producing season to make the comb, but by making artificial combs and inserting them into the hive, the insects began to fill them with honey immediately. Then when one comb was full it could be removed, and a new one put in its place. The honey extractor came next. This would extract the honey from the combs, without loss, in a few minutes.

One invention after another followed, but these three important ones were the direct means of increasing the yield of an ordinary hive from 50 pounds of honey to 100, and even to 500 pounds in one season. In California it is quite common to get 500 pounds of extracted honey from one hive, and the bees are kept busy all through the long season in filling the combs with nectar just as fast as they are emptied. In addition to this large marketable yield, the bees generally raise enough to keep them through the winter.

The methods of keeping and handling the bees have all changed in recent times. In the matter of wintering the bees, the change has all been for the best. Formerly half of the colonies died in winter, but to-day very few deaths occur in the hives that are properly prepared for the cold weather. In the South the bees can be kept in the summer stands through the winter; but in the North they are wintered in cellars, caves, sheds, and occasionally in winter-protected hives in the orchard. The favorite method is to construct a bee cellar, where several hundred hives can be kept at once. These hives are stacked in tiers, one upon another. A thermometer in the cellar enables the apiarist to keep an even temperature in the room, and all through the winter he carefully watches the condition of his bees.

In the early spring the bee keeper goes from hive to hive and counts up the losses that have been inflicted upon his little hosts during the winter. In spite of his utmost care in wintering them, there will be many to die from bad ventilation, diseases, and even the cold. Like a general after a battle, he does not know his losses until the roll has been called. If the queens are all right, he is greatly relieved in mind; but if the queen is missing in any colony, there is danger at once. A new queen must be introduced in the colony, or the colony must be united to another with a queen.

Queen bees are introduced now in a novel way. There are regular queen cages, into which the queens are placed, and one end is stopped up with sugar. The cages are put into the hives next the bees just over the cluster. In a short time the bees discover the presence of the queen, and they begin to eat through the sugar paste to liberate her. They deceive themselves then into the belief that they have hatched out a new queen and joy follows in the hive. If the apiarist attempts to force a queen into the colony in any other way, the bees are very likely to resent the intrusion and sting her to death.

The bee cage was invented to transport the queens through the mails, and also for the purpose of introducing foreign queens among our ordinary bees.

A number of years ago it was found that our semi-wild bees could be greatly improved by introducing among them pure Italian or Carniolan queens. Italianizing our common black bees has gone on apace ever since, and most beginners are advised to begin with these queens. They produce much larger bee workers, and in some respects they show great improvements upon the common insects. The pure German or Carniolan queens are the gentlest, hardiest and most industrious of all bees; and there is just at present as widespread an attempt to Germanize our common black bees as to Italianize them. There are followers of both schools, and neither one will admit that the other is as good as the one they represent.

The cost of establishing a colony of bees depends a good deal upon the kind of bees one secures. A good colony of pure Italian or Carniolan costs from $6 to $8; but our common black bees can be obtained for half this price. It is a question, however, whether, in the end, they would not be more expensive than the improved bees.

Like poultry and eggs, the most of our honey comes from small farms, where the apiarist owns from one to five colonies. But, on the other hand, there are many big bee farms in this country. It is not uncommon to find farms in our Northern States where 500 to 1,000 hives are kept. From one of these farms 20,000 to 50,000 pounds of honey will come in one season. In California, a few bonanza bee keepers own as high as 5,000 colonies each, and they will ship nearly 75,000 pounds of honey from the place in one year. One man in San Diego County, last year, shipped 150 car loads of honey.

Bee keeping has been called the poor man's business, because, no matter how poor one is, he can always keep bees and make a little extra money.

The bees gather their nectar from far and wide, and, as they are no respecters of neighbors' rights, they will rob the honey from the fruit blossoms of the next orchard to put money in the pocket of the poorest farmer. They require little labor and less expense to keep them, and, in return, they store away enough honey to supply the table with many delicacies.

There are regular bee keepers' associations and clubs established all over the country, and at their regular meetings they read papers of a practical and semi-scientific nature. There are several weekly and monthly papers devoted exclusively to the business, while nearly every agricultural journal gives some space to a bee department.

The apiarists have had their share of trouble, and it is only in co-operation that they obtain their rights. Adulteration of honey has been one of the obstacles in their path, and they have persisted in exposing such tricks to the consumers. The comb honey cannot well be adulterated, but strained honey, sold in glass jars, has been widely and extensively adulterated. The adulterations are made of cheap sweets, such as glucose and cane sugar, and in some instances, only 25 per cent of the mixture was honey.

The Agricultural Department, working in the interests of the bee keepers, made searching investigations, and disclosed the fact that the adulterations were done largely by wholesale dealers, and not by the apiarists. Some law to prevent adulteration of honey is now passed in nearly every State.

A few years ago the honey interests of the country were threatened with injury by the reports that poisoned honey had been placed upon the market. The honey in question was said to have come from the regions around the Allegheny Mountains, where the mountain laurel, or Kalmia latifolia, abounds. The bees gathered most of their nectar from the flowers of these plants, which are said to be poisonous. If the bees were so indiscriminate as to gather their honey from poisonous flowers, it would be a pretty serious matter. But the fact is, there has never yet been an authentic case of death due to eating poisonous honey. There have been cases of sickness caused by indulging too freely in this sweet article of diet; but that is nothing more than can be expected. Over-indulgence in candy or any other sweet thing will cause similar sickness. Taken in moderate quantities, honey is considered by most physicians as a desirable and healthful article of diet, and its increased supply and cheapness are really benefits to the human race.

Mr. Eddy's Vistascope.

Mr. William A. Eddy, who has a well deserved reputation for his experiments in kite making and flying, has devised what is termed a "vistascope"—an instrument which enables persons on the ground to view the surrounding country with almost the same effect as if they were at the elevation of the kite. The vistascope looks something like a huge magic lantern. It is designed on the lines of the ordinary camera obscura, but the pictures are thrown from a mirror set in the top upon a sheet of semitransparent paraffine paper. This does away with the reversed effect of the ordinary camera obscura.

By lying on his back with his feet toward the view to be seen, the observer sees the landscape stretched before him in its proper condition. There is, moreover, a peculiar effect of being in the air on a level with the vistascope and looking out over a level stretch of country. The apparatus recently used by Mr. Eddy measured 5 × 2½ feet and was carried up by a team of Eddy kites reinforced by a Hargrave box kite. The vistascope was sent up to a height of 150 feet. Mr. Eddy lay flat on his back with a powerful field glass and looked up at the reflector of the camera obscura. He was able to see objects with great clearness; houses and trees a mile and a half distant were distinctly seen. The kite cord was let out until the vistascope was 300 feet in the air, but the trials were less satisfactory, because of the swaying of the kite line, which rendered it extremely difficult to follow the motion of the apparatus with the field glass.

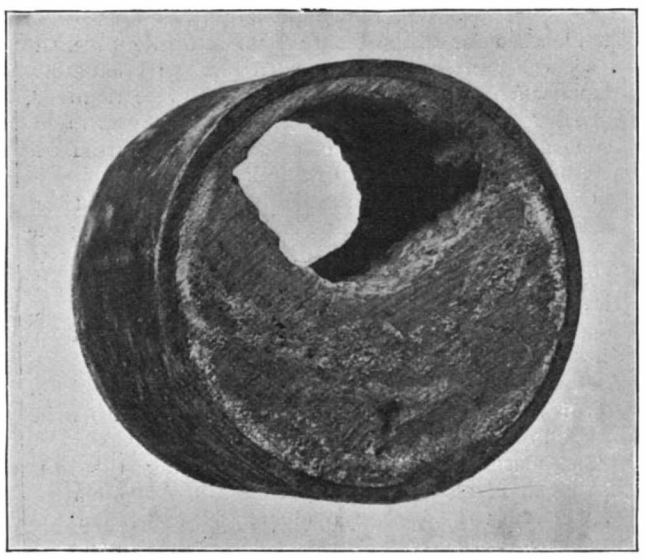
Return of the Jackson Expedition.

The steamer Windward from Franz Josef Land was spoken off the coast of Scotland on August 28, and it was reported that all were well. This expedition was fitted out by Mr. Harmsworth and was commanded by Mr. Jackson. The vessel sailed three years ago. The first two years' work of the party was very successful, although it did not succeed in making the Franz Josef Archipelago a basis for a dash on the North Pole. This was a part of Mr. Jackson's provisional programme—to prove that the existing map of that Arctic outpost is very erroneous; and his work, together with the drift of the Fram, proved that the islands do not extend as far toward the pole as it was formerly surmised. The collections made the first two years of the expedition were important, and it was Jackson who met and succored Nansen and Johannsen when they were on their way to Spitzbergen over the ice a year ago.

© 1897 SCIENTIFIC AMERICAN, INC.

THE CORROSION OF A BOILER TUBE.

We are indebted to Mr. H. H. Shank, of Harrisburg, for the photograph of a section of a water tube which we present herewith. It was recently taken out of a Babcock & Wilcox boiler, in use at a large steel plant near Harrisburg, Pa. It is a striking example of what is apt to take place if the water is dirty or holds mineral salts in solution. The deposit in this case seems to be simply mud, which was held in suspension by the water at the time of the entrance to the boiler and afterward deposited. The tube is four inches in diameter, and more than three-fourths of the water space is filled with the deposit. The tubes were removed and new ones put in. It is a good object lesson, showing the necessity of frequently examining the boilers, as it is easy to see that the results obtained from boilers in such a condition must necessarily be uneconomical.



THE CORROSION OF A BOILER TUBE.

A Carthaginian Mask.

In 1893, the Rev. A. L. Delattre, having had his attention called by an Arab to several small objects that he had discovered while making some excavations at Douimes, decided to make some researches in the vicinity, says Cosmos. Toward the latter part of the summer of that year, having engaged some laborers and set them to work, he was soon rewarded, after excavating through six feet of soil intermixed with rubbish, by the discovery of the primitive argillaceous earth in which the Carthaginians found a last resting place for their dead. In November, 1893, there had been discovered sixty tombs, almost all of which were placed at right angles with the seashore. The majority were simple trenches covered with slabs of tufa, the only kind of stone employed in the primitive structures of Carthage. Infiltrations had filled each trench with a fine yellow sand, the color of which was often confounded with that of the natural earth. The funereal furnishings usually consisted of two medium sized urns with a handle on each side, of two small jugs with a single handle, of a flat bicornous lamp and its patera (a sort of saucer), and sometimes of a bronze hatchet, a hand bell, cymbals and a mirror or other objects of ornament, such as collars, rings, bracelets, earrings, painted vases, figurines, amulets, shells, etc.

One of the most interesting finds was a curious terra cotta mask, brought to light in September. It was discovered at a new point of the Punic necropoli of Carthage, very near the site of Serapeum, in a very small space where had just been found more than twenty Carthaginian tombs, always containing funereal furnishings of the same character, save that the pottery was more highly ornamented and of finer quality. The mask is 8 inches in height and 5 in width, and the hollow part 3½ inches in depth. This grotesque face, with low and narrow forehead, projecting eyebrows, wide and flat nose, and angular cheeks and crooked mouth, preserves a few traces of black paint. The mouth and eyes are cut out through the thickness of the clay and the ears are ornamented with rings. Around the mask are distributed five holes—one at the top and one beneath and one above each ear. These holes certainly served for fixing the mask in place. There is nothing Egyptian nor Greek about the style of the work, and the specimen seems to be an authentic one of local art. In fact, at the base of the forehead and at the origin of the nose, it bears the mark of its Punic origin in the crescent surmounting the disk, which it embraces with its depressed horns—an emblem that is very frequent upon the votive stelæ of Carthage, and which we often find engraved upon the bezel of rings or arranged so as to be strung and worn as an amulet.

One peculiarity that this mask exhibits is that it changes physiognomy according as it is viewed in profile, at an angle, or full face. This mask constitutes a true caricature. Contrary to the opinion held up to recent years, the Carthaginians must have practiced the art of portrait taking. Prof. Duhn, in an article recently published at Berlin, observes that several Punic masks in the Saint Louis Museum remind us of Japanese rather than of Mediterranean art, on account of the extraordinary naturalism exhibited therein and that makes true portraits thereof. Such is the first impression, but a profounder study of these interesting pieces permits us to recognize an entirely archaic art in them. The mask under consideration is less than natural size and consequently could not have been applied to the face of a corpse; neither was it suspended in the tomb. Notwithstanding the holes with which they are provided, these sort of masks, as well as the clay statuettes that are found in the necropolis, were simply placed alongside of the dead. The object of the relatives or friends who inclosed these objects in the tomb was merely to know that the body of the defunct was accompanied with an object to which they attributed a magic virtue capable of protecting the mortal remains in their final dwelling. Such masks have been discovered in the most ancient necropoli of Sardinia. The Cagliari Museum possesses several of them.

How Worry Affects the Brain.

Modern science has brought to light nothing more curiously interesting than the fact that worry will kill. More remarkable still, it has been able to determine, from recent discoveries, just how worry does kill.

It is believed by many scientists who have followed most carefully the growth of the science of brain diseases, that scores of the deaths set down to other causes are due to worry, and that alone. The theory is a simple one—so simple that anyone can readily understand it. Briefly put, it amounts to this: Worry injures beyond repair certain cells of the brain; and the brain being the nutritive center of the body, the other organs become gradually injured, and when some disease of these organs, or a combination of them, arises, death finally ensues.

Thus does worry kill. Insidiously, like many another disease, it creeps upon the brain in the form of a single, constant, never-lost idea; and, as the dropping of water over a period of years will wear a groove in a stone, so does worry gradually, imperceptibly, but no less surely, destroy the brain cells that lead all the rest—that are, so to speak, the commanding officers of mental power, health, and motion.

Worry, to make the theory still stronger, is an irritant at certain points, which produces little harm if it comes at intervals or irregularly. Occasional worrying of the system the brain can cope with, but the iteration and reiteration of one idea of a disquieting sort the cells of the brain are not proof against. It is as if the skull were laid bare and the surface of the brain struck lightly with a hammer every few seconds, with mechanical precision, with never a sign of a let-up or the failure of a stroke.

Just in this way does the annoying idea, the maddening thought that will not be done away with, strike or fall upon certain nerve cells, never ceasing, and week by week diminishing the vitality of these delicate organisms that are so minute that they can only be seen under the microscope. — Pharmaceutical Products.

RAILWAY MAIL CATCHER AND DELIVERY DEVICES.

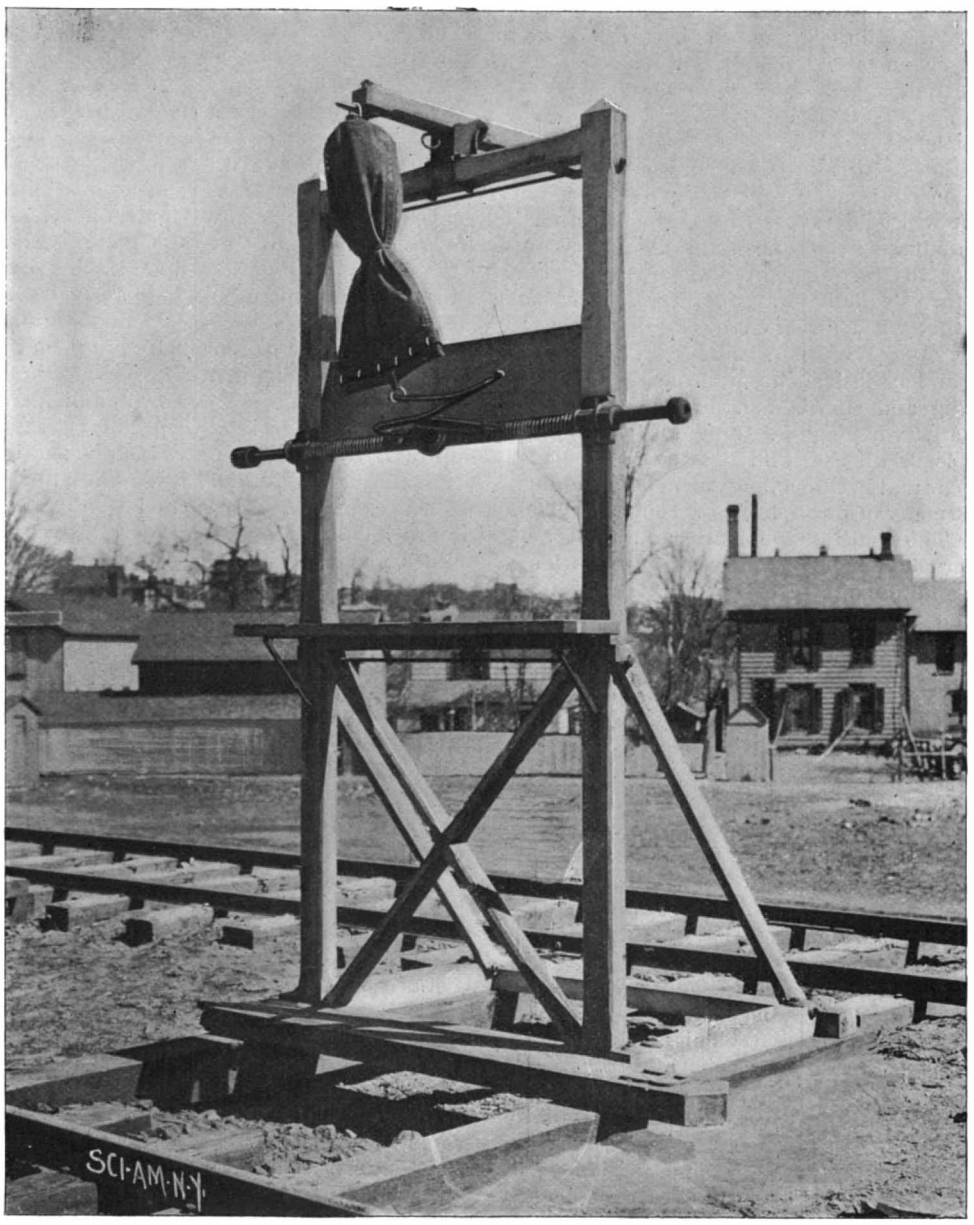
In the SCIENTIFIC AMERICAN of August 14 and August 21 we described and illustrated two systems of mail catcher and delivery devices which have been approved by the Post Office Department and recommended for adoption by the various railroads, and the accompanying illustrations represent the appliances and operation of still another system, the Winsor, which has met with similar governmental indorsement. Of all these systems it may be said that their completion, in their present practical operative form, is a matter of comparatively recent date, considering how many years inventors have been working upon this subject, and the great number of patents issued in this field.

So, too, the number of railroads which have failed to supply themselves with improved mail catcher and delivery devices is still very large, although it is fair to presume that progress in this direction will now be more rapid, from the fact that several devices have received official sanction, as well as because the public are becoming more insistent, year by year, on all matters tending to promote rapid transfer and handling of the mails.

The Winsor device (C. B. Winsor, general manager, Jamestown, N. Y.), attached to the car, comprises two main parts, the upper one of which forms the catcher and deliverer, while lower down is a swinging arm, being a half circular steel bar having a bow shaped spring on its extreme end to hold in position the lower ring of the pouch as it is held out from the car, as shown in one of the illustrations, and assist in holding it steadily in position to be engaged by the catcher on the crane at the station. The catcher and deliverer is supported by a steel bar extending across the car door, the bar rotating in half a circle in a plate bolted at one side of the car door, whereby the whole device may be swung down out of the way at the side of the door.

Upon that portion of the steel bar between the two projections of the bracket at the side of the car door is a collar with a lug to engage a projection on the back of the bracket to hold the catcher arm in horizontal position. A coiled spring at each side of the collar, bearing on the projections of the bracket, holds the lug in operative position and at the same time breaks the force of the blow on the catcher arm when the pouch is caught.

The catcher arm rotates with the bar by a sleeve extending from which is a handle at right angles to the catcher, and the latter itself



MAIL BAG IN POSITION AT STATION TO BE TAKEN BY APPROACHING TRAIN

WINSOR MAIL CATCHER AND DELIVERER.

© 1897 SCIENTIFIC AMERICAN, INC.

is bent to form a parallel side jaw, and contains besides a spring-actuated bar, pivoted on the inner side of the jaw and normally engaging the other side, but opening on the passage of the bag into the jaw and closing behind it. When the pouch enters the catcher arm, it slides the bar past a catch and allows the arm to drop to the side of the car, the bag being securely locked as soon as caught and avoiding all danger of being thrown under the cars. The mail clerk does not have to hold the device while catching and delivering pouches, but simply pulls down a handle which throws the pouch out to position, and holds it set to such position as the car approaches a station.

Our view representing the exchange of car and station mail bags is made from a photograph showing the making of such exchange when the car was traveling at the rate of forty miles an hour, although the device has been tested with trains running at all rates of speed up to sixty miles an hour.

The catcher and deliverer bar on the crane at the station is made of steel tubing, on which are fastened the bearings, to which an arm similar to the catcher used on the car is pivoted, the supplemental interior spring-actuated rod for holding the bag after it is caught being clearly seen.

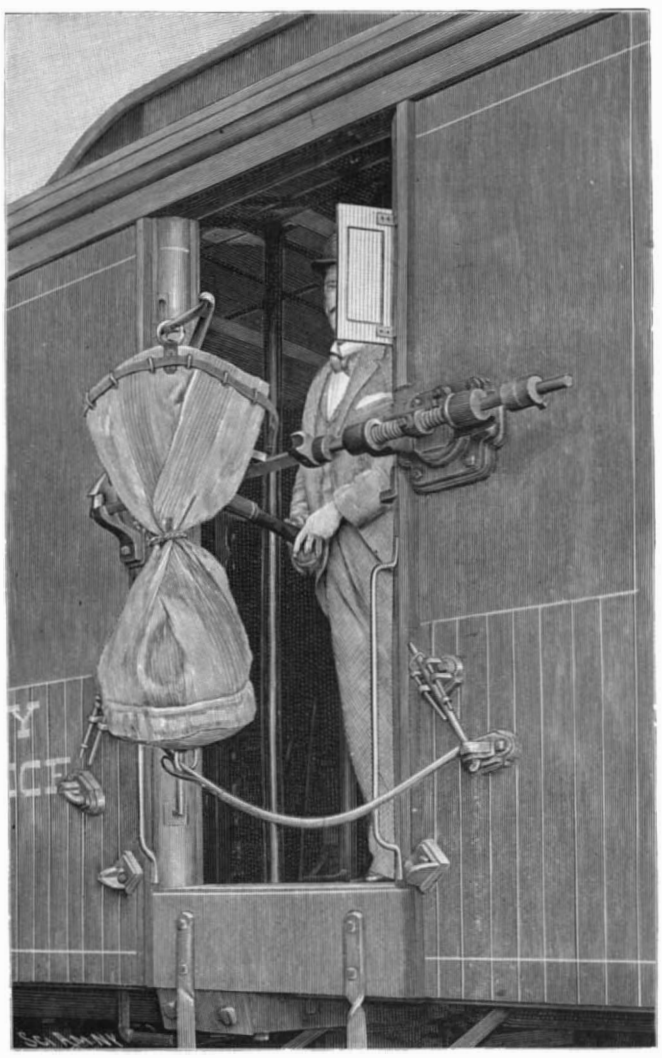
The coiled springs on each side of the catcher fork break the force of the blow when the bag is received. The device on both the car and train is readily reversible, to receive and deliver mail bags when cars are going in opposite directions.

MAIL BAG LEFT BY TRAIN AT STATION.

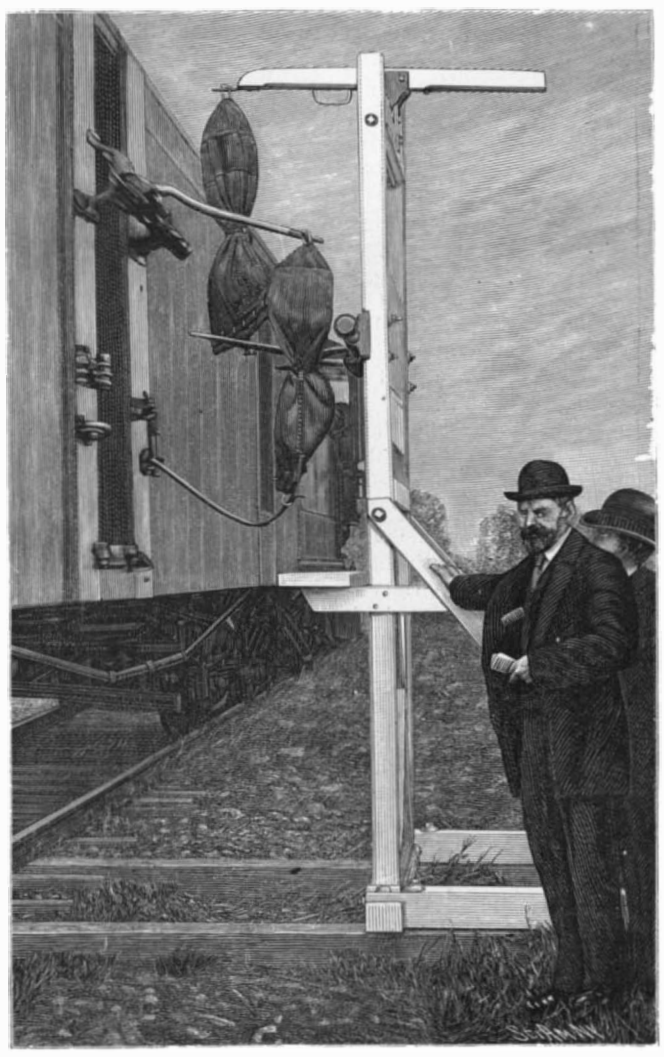
MAIL CATCHER AND DELIVERER.

Lessening the Dangers of Fog.

Nothing is worse than fog at sea. A storm may cause discomfort, and accident may cause delay, but in neither case does the traveler feel so helpless as when his vessel is completely shut in by a dense fog. To lessen the danger which then exists, Prof. E. C. Pickering, the director of the Harvard College Observatory, suggests, says Nature, in a pamphlet, a method of determining the position of a vessel in a fog based upon the velocity of sound. If two fog horns of different pitch be placed at equal distances from the middle of a channel or entrance to a harbor, and be sounded simultaneously at regular intervals of about a minute, it will be evident that a captain of a vessel will be able to locate his position with fair accuracy by noting when the sounds of the horns are heard. If the two sounds are heard at the same instant, the vessel will be in the middle of the channel, and if they are heard after one another, it would be possible to judge from the interval between the two how much the vessel is out of the middle of the channel. For vessels passing one another, Prof. Pickering suggests that each should whistle or blow the horn or siren as soon as the sound is received from the other vessel. Then, if they are five miles apart, each will whistle every fifty seconds, and the distance in miles between the two vessels can always be determined by dividing the intervals in seconds by ten. By placing two different fog whistles on a long steamer, one at the bow and the other at the stern, and arranging that the sounds emitted by both should be heard together by an observer standing at the bow, many collisions might be prevented. Instructions could be given to sailing vessels to keep quiet so long as both signals were heard separately, for they would then be in no danger, but to fire a gun or make other loud noise when both whistles were heard together, for they would then be in front of the steamer. These various methods may be combined indefinitely, and they seem to be worth the consideration of navigators.



MAIL BAG HELD OUT FROM CAR APPROACHING STATION.



EXCHANGING CAR AND STATION MAIL BAGS.

WINSOR MAIL CATCHER AND DELIVERER.

Philippium, a New Element.

M. Marc Delafontaine announced some years since that Mosander's erbia contains two yellow earths, which he named terbia and philippia. The latter was questioned, but accepted later. Now the discoverer has worked out his investigation. Philippium has been found in gadolinites, samarskite and fergusonite. The article in the Chem. News (May 14) describes the compounds, from which the metal is inferred, and its relationship to other elements. Its symbol is Pp.

Philippium is more closely allied to cerium and terbium than to any other of the yttrium and cerium metals. It is to yttrium what cerium is to lanthanum. Its equivalent, the color of its subnitrates and that of the philippic salts, the solubility of its formiate, separate philippium from terbium. These characteristics, and the solubility of potassium-philippo sulphate in potassium sulphate solutions, distinguish it from the two ceriums of M. Brauner and M. Schutzenberger. A heated mixture of cerium nitrate with that of the fergusonite earths (left after the removal of Pp) does not behave at all like the original nitrates; the residue of cerium subnitrates does not resemble the corresponding compound of philippium. Terbium nitrate melts into a colorless glass, which, after partial decomposition, is not yellow, and leaves no yellow residue after washing.

AN improved diving bell of great capacity, moving along the sea bottom by means of screws moved by electricity, is on exhibition in Paris. It is the invention of an Italian named Piatti del Pozzo. He states that it can be worked at very great depths and holds air enough to supply the crew for forty-eight hours without renewal. It is lighted by electricity, which also furnishes motive power for any tools that may be used. On tipping over the cases of ballast, the bell rises to the surface itself.

© 1897 SCIENTIFIC AMERICAN, INC.

Science Notes.

Verestchagin, the Russian battle painter, will be the first recipient of the Nobel prize, given for "the propagation of pacific ideas," it is said, as his pictures have brought out the true horrors of war. Kaiser Wilhelm calls them "the best assurance against war."

According to Herr Levinstein, the action of the rarified air on the animal organism is to produce a very strong fatty degeneration of the heart, the liver and the muscles, while death sets in through want of oxygen. The experiments from which these facts were ascertained were performed on a rabbit at 30 or 40 centimeters pressure.—Revue Scientifique.

The Coast and Geodetic Survey has authorized Augustus F. Rodgers, in charge of the bureau's San Francisco office, to proceed with an assistant to the head of the Lynn Canal, Alaska, and make a thorough survey of that part of the Klondike route. Particular attention will be given to the topography and hydrography of the Skaguay and Dyea localities. Mr. Rodgers will leave at once.

The lightest substance known is said to be the pith of the sunflower, with a specific gravity of 0·028, while elder pith—hitherto recognized as the lightest substance—has a specific gravity of 0·09, reindeer's hair 0·1, and cork 0·24. For saving appliances at sea, cork with a buoyancy of 1 to 5, or reindeer's hair with one of 1 to 10, has been used, while the pith of the sunflower has a buoyancy of 1 to 35.

Italy has produced the smallest book in the world, a volume of 208 pages measuring 10 millimeters by 6, or four-tenths by a quarter of an inch. Each page contains 9 lines and from 95 to 100 letters. The text is an unpublished letter written by Galileo in 1615 to Mme. Cristine, of Lorraine. The printers are the brothers Salmin, of Padua, who in 1870 produced the microscopic edition of Dante's "Divina Commedia," 38 by 22 millimeters in size, with 31 lines to the page.

The influence of hygienic improvements on the rate of mortality is well shown by the figures below, which give the mortality of the years 1882 and 1895 in the world's greatest cities:

	1882	1895
Paris	26·3	21·1
Rome	26·1	20·8
Berlin	26·4	19·0
Amsterdam	24·3	17·6
Rotterdam	23·5	19·7
Vienna	29·2	23·1
St. Petersburg	35·2	27·2
New York	30·6	22·4

New York shows the greatest improvement.

The discovery by M. Sabouraud of the microbe of seborrhœa (suet flow), or the "bacillus of baldness," attracted much attention, and a special meeting of the Paris Academy of Sciences was held recently, at which the matter was discussed. M. Brocq remarked that the seat of the bacillus was not in the hair follicle, and that its action on the skin could not be explained. M. Sabouraud had said it was from a toxin; but from his experiments the toxin apparently worked at a distance from the hair follicles, at least in the rabbit, while in man it acted locally if the bacillus was always the cause of the seborrhœa and the baldness. All clinicians knew that temperament played an important part in the matter of seborrhœa and alopecia (fox mange). As regards the latter, the arthritic diathesis had to be considered; as regards the former, the lymphatic. In a non-arthritic person baldness never occurred, not even when abundant seborrhœa was present. Clinically, seborrhœa must not be confounded with baldness. If baldness was always due to a microbe, it should be easily contagious, and it was not so, except as accessory to some other disease. M. Jacquet considered that the rabbit was not a good subject, for baldness can be easily produced in that animal by the simple application of bisulphite of lime. M. Darier stated the histological analogies between seborrhœa and baldness; but as the results on the clinical side were different from those of the laboratories, it was impossible, without further information, to identify the two lesions. M. Barbe said that many seborrhœic patients never had the least amount of falling off of the hair. M. Sabouraud replied, in effect, says Nature, that members used similar arguments when Pasteur laid the results of his studies of fermentation before them.

Disreputable Patent Competitions.

We have recently received a copy of a paper called the National Recorder, issued by a firm of Washington patent attorneys, claiming that a million copies of their journal are regularly printed, and who offer monthly medals and prizes for especial ability in invention, to inventors taking out patents through their agency. This is one of the many "catchpenny" devices bringing discredit upon the patent system of this country. In the heat of securing prize money, young men and mechanics are induced to take out patents upon unsalable inventions, squandering money and time to the ultimate benefit of no one except the patent attorneys. Perhaps for sale abroad such a medal may give an undue importance to a trivial invention, but we cannot see any way in which such a system can be of advantage in legitimate business. No one who has ever patented an invention has failed to receive from one or more companies very flattering letters concerning the value of his invention and its patentability abroad, with the offer of a medal or a diploma for a small fee, though the fee is always much greater than the value of the medal received and there is no intent on the part of the grantor of the medal beyond the deception of the unfortunate patentee who may be allured by their flattery. There are in France and in this country respectable patent competitions whose medals attest the excellence of inventions, but these competitions are not administered for the purpose of inducing applications for patents through particular firms, but are offered by such institutions as the Franklin Institute and the French Institute for the Encouragement of National Industry. These legitimate prizes are not fictitiously offered and their awards have real value, while such schemes as those presented by the firm in question can only have the effect of increasing the number of useless patents and of bringing discredit on the whole system of issuing patents.—The Journal of Electricity.

Eye Sanitation.

If one organ more than another in the human body should have all the benefit of prevention, it is the eye, and yet to what abuses do we not see it daily and hourly subjected, says the Independent. People will read while riding on jolting cars, they will read by a poor light, not reflecting how much wiser and pleasanter it is to pay money to the gas man than to the oculist. There are many expedients that will help to preserve the sight of workers who can have but little time to rest; by closing the eyes for a few moments, or by looking off at a distant object so as to change the focus completely, and thus resting those parts of the retina that have been in use continuously for a long time, much may be gained. Then when one feels that the sight is failing, do not delay going to an oculist, and having him furnish you with a formula for the glasses that your eyes need, and at the same time secure the services of a good optician. The "mathematics of the eye" are very well understood now, and the law that will make the light enter the eye at just the angle to correct the aberration that age has made will give you great comfort, and do much to prolong the usefulness of your eyes. The skillful way in which astigmatism and near-sightedness are now corrected is a matter to rejoice over. One person asks: "Is it not dreadful to see such numbers of young children going about the streets with glasses on? Are everybody's eyes degenerating?" Not at all. The child who, fifty years ago, would have been unable to learn to read from sheer inability to see the letters, is now able to keep up with his fellows, and escapes the inevitable headache that comes from eye strain, simply because a well-adjusted pair of glasses has been supplied to him. As to the carelessness of employers, in failing to provide a good light for men who write all day, and whose eyes must pay the penalty—there is no greater field for the application of the Christian rule "Do unto others," etc., than here. This is seen more often in the city than in the country; but even here, we should like to see the census of the men who have made it a matter of conscience to supply a perfect light for their clerks and other employes. Then, when you learn that a cataract is forming, do not despair; in these days of advanced surgery they are removed with but little injury to the vision. Tight shoes, tight collars and tight waists are detrimental to eyesight, by causing undue pressure on the brain; but of all the destroyers of this precious possession of perfect vision, veils are the worst. One wealthy oculist, owning a fine city mansion, in talking with a friend, saw a lady with a finely dotted veil pass. Said he: "Those are the things that have built my house." Very lately the following experiment was tried:

"Dr. Casey A. Wood, of Chicago, selected a dozen typical specimens of veils and applied the ordinary tests of ability to read while wearing them. These tests showed that every description of veil affects more or less the ability to see distinctly, both in the distance and near at hand. The most objectionable kind is the dotted veil. Other things being equal, vision is interfered with in direct proportion to the number of meshes per square inch. The texture of the veil plays an important part in the matter. When the sides of the mesh are single, compact threads, the eye is much less embarrassed than when double threads are employed. The least objectionable veil is without dots, sprays or other figures, but with large, regular meshes made with single, compact threads. Eye troubles do not necessarily result from wearing veils, for the healthy eye is as able as any other part of the body to resist the strain they impose upon it. But weak eyes are hurt by them and prudence should teach not to strain healthy eyes too much."

ISAAC F. BASSFORD, of Helena, Mont., is probably the oldest inventor in the world. He is ninety-seven years old, and is now trying to find some one to buy a half interest in a new invention.

Archæological News.

Ancient Egyptian doctors knew the groin and the perineum and had a name for each, which M. V. Loret, of Lyons, has discovered in medical papyri. The terms occur in the celebrated Ebers papyrus, but the meaning had not been proved.

The museum of African antiquities in the art of the Mussulman has been opened at Algiers, and a large number of antiquities have already been placed in it. The museum is in one of the most beautiful of the public gardens. It is in a position which can hardly be surpassed.

An important archæological discovery has been made near Thermopylæ, between the old barracks and the water mills. On making excavations there were laid bare a number of sarcophagi containing ores, vases, coins and medals. It is believed that the skeletons were the remains of the Spartan hosts of Leonidas.

Another fragment of the famous Parian chronicle, part of which is in the Ashmolean Museum at Oxford, has been found on the island of Paros. It is very important, as it contains the chronology of the years from 336 to 299 before Christ, the period of Alexander of Macedon, and of the Diadochi, the generals who divided his empire among themselves.

The foundation stone of the new museum destined to contain the collection of Egyptian antiquities of Gizeh was laid in April by the Khedive, the ceremony being attended by the ministers, high officials, diplomatic corps and a few invited European residents. An Egyptian monolith coffer which dated from about 2500 B.C. was used to hold a box containing the documents, coins, medals, European journals, etc.

M. Berthelot, the chemist, reports that the copper objects found at Negadah and Abydos, in Egypt, by M. De Morgan are of pure copper and not of bronze. Among them are a button, a curiously shaped pair of scissors, and some needles. The inscriptions found on the tombs are so old that they have not, as yet, been deciphered. They are believed to date from the First Dynasty or earlier. M. Berthelot thinks that the evidence of a copper age is conclusive.

The design for the monument to be erected to the late Lord Leighton in St. Paul's Cathedral—where the late president of the Royal Academy is buried—has been submitted to the Prince of Wales and approved by his royal highness. The memorial is to be in the form of an altar tomb, supported by emblematic figures, and will be executed by Thomas Brock, R.A. The committee, of which the Prince of Wales is chairman, announces that the monument will cost £2,500, of which all but £100 has been subscribed.

Sir A. Wollaston Franks, K.C.B., president of the Society of Antiquarians and for many years the keeper of the British Museum, recently died in London, at the age of seventy-two years. His chief collections were of Chinese and Japanese porcelains and of English pottery. These collections have been presented to the British Museum. He also had probably the finest collection of rings in existence, besides one of gold ornaments and one of book plates. His greatest archæological service was the discovery of what he called "the late Celtic" period of art.

The Journal Egyptien announces the finding of an excellently preserved avenue of sphinxes, leading to a temple built by Rameses III, near the outskirts of Luxor. The entire place was buried under the sand. The most of the temple, as well as a considerable portion of the avenue of sphinxes, has been uncovered.

M. De Morgan has returned to France, leaving the Egyptian exploration in the hands of Mr. Loret, the well known Egyptologist from Lyons. He was his collaborator in the first volume published on the Dashner. M. De Morgan will in the fall take the direction of extensive excavations in Persia.

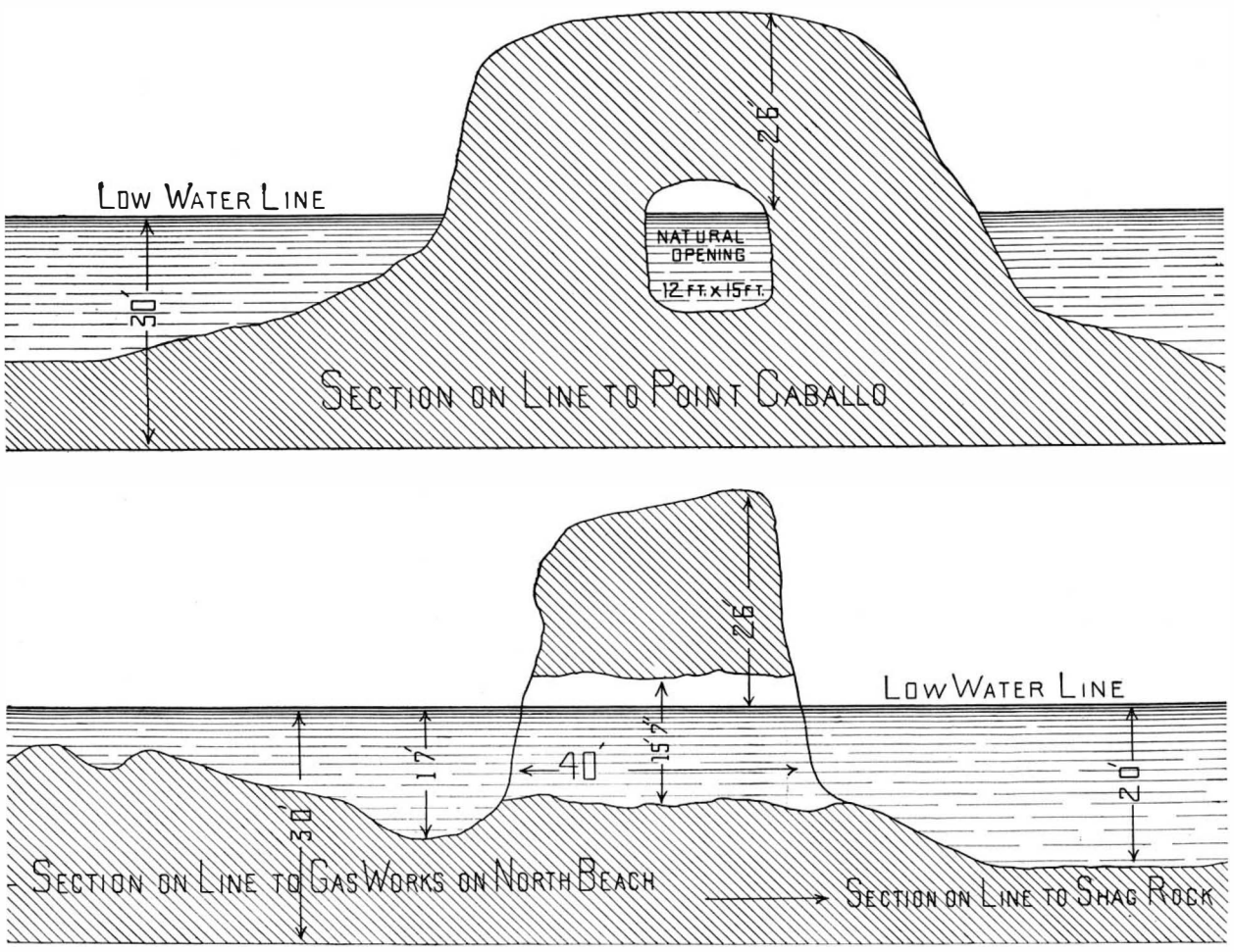
It is generally thought that among the ancient civilized peoples the Romans had the most perfect system of water supplies. But excavations in Greece have shown that in several respects its inhabitants were more advanced in the art of laying aqueducts than their Italian neighbors. Their water was brought to them in subterraneous ducts, so that greater purity was secured, and the liquid was kept cool. The very fact that the Roman aqueducts are more visible, as being over ground, probably accounts for the fact that Roman constructions have enjoyed worldwide fame, while the superior Greek art was unknown in this respect.

M. Osiris, who has bought the historic château of Malmaison in order to save it from ruin, has intrusted to M. Daumet the task of overseeing its repair and (to a certain extent) restoration, says the Builder. The personal apartments of Napoleon are to be brought back to their original condition—his library, his private room, and Josephine's bedroom, dressing room, and bathroom. The first floor, which is in a ruinous state, is to be rebuilt and transformed into a series of galleries in which will be placed all the souvenirs, artistic objects, furniture, bronzes and medals which are connected with the career and the reign of Napoleon.

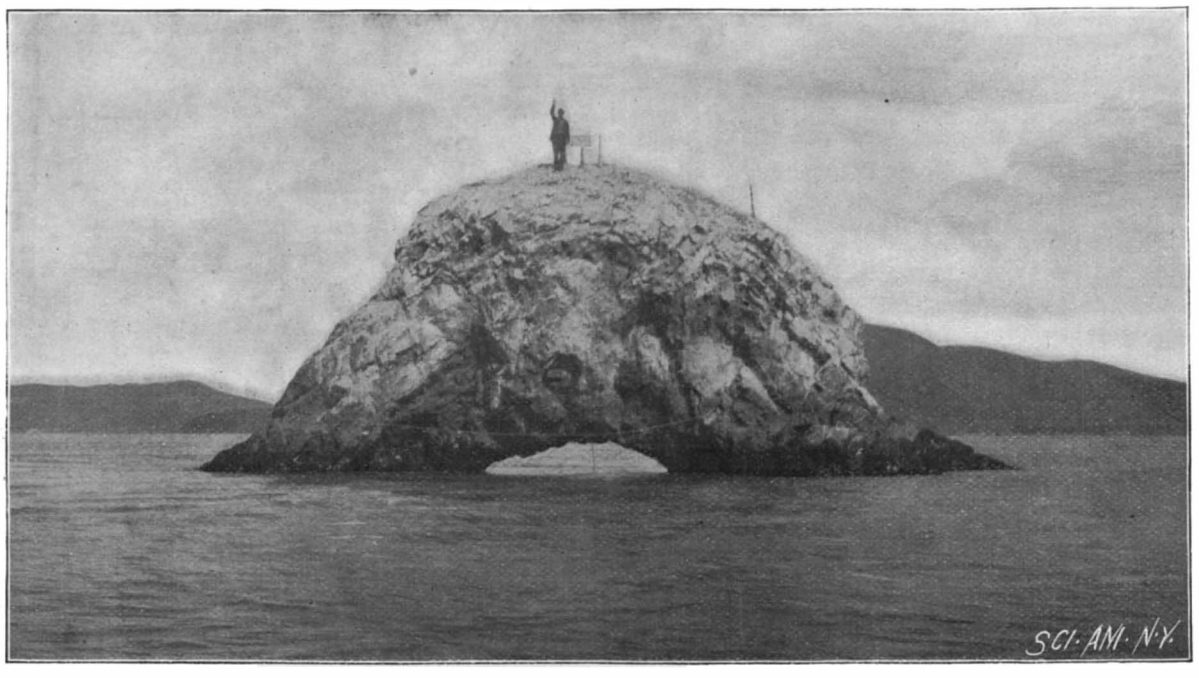
© 1897 SCIENTIFIC AMERICAN, INC.

"ARCH ROCK," SAN FRANCISCO BAY.

Of the twenty-four dangers to navigation which have been located and charted in the bay of San Francisco, the one known as "Arch Rock" is the most conspicuous. Situated just one mile due west of Fort Alcatraz, it separates the north and south channels of the harbor, and is plainly visible to all vessels that enter or leave the port at all stages of the tide. It stands just before the eastern entrance of the Golden Gate, and is the first object in the bay that the swells from the Pacific strike. On account of its visibility, "Arch Rock" is easily avoided by navigators, though a number of wrecks have occurred at this point. Above the water line the dimensions of the rock are small. Its height above low tide is but 26 feet and its length about the same. An arch about 12 feet in diameter, through which small boats sometimes pass, has been worn through the center. Below water the rock expands gradually, so that in order to obtain a uniform depth of 30 feet at low tide, as is contemplated by the engineers, a bulk over 300 feet in diameter must be removed. In response to a memorial addressed to Congress by the commercial bodies of San Francisco, a survey of some of the most prominent dangers to navigation that obstruct the bay was ordered, and that of "Arch Rock" is now complete. Through the courtesy of Otto Von Geldern, the engineer making the surveys, profiles of the rock, east and west and north and south, have been prepared especially for the SCIENTIFIC AMERICAN. They give an excellent idea of the task involved. The rock is soft sandstone and easily disintegrated by explosives. The plan recommended by the engineer is to drill holes to the required depth and charge with dynamite. Drills can be operated either from boats or from stationary platforms resting upon the face of the rock, and adjustable for all depths and contour, and easily operated at all stages of the tide or condition of the weather, excepting in violent storms. The softness of the rock will permit rapid progress when the work is begun. Not more than two seasons will be required for preparation, and one blast, it is calculated, will utterly obliterate the rock as it now stands. The engineer calculates that 40,000 cubic yards of rock must be removed in order to attain the required depth of 30 feet at low tide. The plan pursued in blowing up the rocks at Hell Gate, New York Harbor, was considered, but the engineer believes that the work can be quite as effectively performed and much more cheaply by drilling from the exterior. It is believed that the whole expense will not exceed $100,000.


LOW WATER LINE
NATURAL OPENING
12 FT. x 15 FT.
SECTION ON LINE TO POINT CABALLO
LOW WATER LINE
40'
SECTION ON LINE TO GAS WORKS ON NORTH BEACH
SECTION ON LINE TO SHAG ROCK

VERTICAL SECTIONS THROUGH "ARCH ROCK," SHOWING NATURAL TUNNEL WORN OUT BY ACTION OF WAVES.



"ARCH ROCK" IN SAN FRANCISCO BAY, SHORTLY TO BE REMOVED BY THE GOVERNMENT.

Geology of the Yukon Region.*

BY G. FREDERICK WRIGHT.

The expeditions of the Canadian Geological Survey to the Yukon region, ten years ago, established three things having an important bearing on the gold prospects in Alaska and the Northwest Territory.

1. The gold-bearing strata which have been so productive all along the western coast of America extend without essential change into the Upper Yukon Valley as far as the Arctic Circle. Throughout the whole extent of the mountain ranges which face the Pacific Ocean the same forces have been at work. Along a wide belt throughout nearly the entire length of the continent a belt of paleozoic schistose rocks have been fractured and filled with a network of quartz veins bearing more or less gold. McConnell reported essentially the same formations where the Yukon crosses the Arctic Circle that he had been familiar with west of the Rocky Mountains, the entire distance south to the United States boundary.

2. The Yukon River occupies a very old line of drainage. Its drainage basin has been elevated so long above the sea that the river has had time to cut long and deep canons across rocks of different geological ages, and to establish a pretty uniform gradient for a distance of nearly 2,000 miles. Schwatka built his raft at the head of Lake Lindeman, twenty-three miles from the summit of the Chilkoot Pass, and was transported on it 1,300 miles, with only two or three short portages above Miles Cañon, about 150 miles from the place of its construction. But the same raft was used the entire journey. From Miles Cañon the river is navigable for a distance of nearly 2,000 miles.

The significance of this is that it indicates an enormous period during which erosive agencies have been active in the valley. All young rivers crossing such diverse geological formations are obstructed by waterfalls or rapids impassable to navigation. The gold, therefore, which is found in the placer mines of the Yukon is the accumulation from an immense amount of disintegrated rock. If the veins near the surface have been very rich, an enormous amount may be expected from the placers. But from the amount of erosion, a considerable accumulation may have arisen from veins of very low-grade ore. The geologists, therefore, were not able to make any prophecies as to the amount of gold to be expected. Nor is there any certain basis to go upon even after the present discoveries. There is little probability that anything but rich placer mines can ever be worked there with profit, and it is altogether likely that the placer mining will always be of the most hazardous kind.

3. The effect of glacial erosion, to which reference is occasionally made in the papers, must be limited to the upper part of the Yukon Valley, considerably above the region of the richest discoveries. Russell, Dawson and Hayes all agree that, while glaciers formerly enveloped all the island along the Pacific shore of southeastern Alaska, they were of very limited extent on the northern side of the mountains which form the southern border of the mainland. Indeed, the glaciers on the northern flanks of these mountains scarcely pass the sixty-second parallel, not reaching even to old Fort Selkirk. Hence, there is not much probability that any large amount of gold has been carried by ice action from one drainage basin to another. The gold of the placers in the Klondike region is probably all of local origin, arising from the disintegration of the rocks through which the stream and its tributaries have flowed.

The conditions of life in that region are almost inconceivable to those who have not paid especial attention to them. Russell reported at repeated places along the middle Yukon that ice took the place of ordinary rock. Bluffs along the river on whose surface forests were growing would appear on close approach to be precipitous walls of stagnant ice covered with a small amount of soil and a deep carpet of moss. Anywhere on the surface one had but to dig down a few inches to find solid ice. Indeed, the ground never thaws there to a depth of more than a few inches. The placer mining will always have to be in frozen soil, except on the margin of the large streams. But the rich placers are on the small streams from thirty to one hundred miles back from the Yukon.

The region is a regular rat trap. Up to the middle of September parties can without much trouble get over the Chilkoot Pass with a small amount of equipment, and can work down the river 600 miles, as Schwatka did, on rafts or boats of their own construction. But, once in at that time of year, there is no possibility of their getting back until the next June. The same is true about the ascent of the river, which freezes up in September and is not only unnavigable, but well-nigh impassable until the following June. The lower part of the stream freezes up earlier and thaws out later than the upper portions; consequently, the ice dams in the lower portions make floods of the most disastrous kind, and when those of the autumn subside they leave the ice so rough that it is unfit for sledging. If reasonable calculation could be made concerning the numbers to be there in the winter, provision could be made for them during the three months when the river and the passes are open. But it is now too late for this year, and there seems little doubt that adventurers will flock to the region beyond all probable means of support and will be beyond reach of assistance. One dreads to hear the story which the mails of next spring will reveal.

*The Independent, N. Y.

© 1897 SCIENTIFIC AMERICAN, INC.

Weeds Most Troublesome to Farmers.*

Wild lettuce, Russian thistle, Canadian thistle, Spanish needle, oxeye daisy (a species of chrysanthemum), wild and black mustard, purslane, stick weed or beggar's lice, burdock, yellow dock, bracted plantain, horse nettle, buffalo bur, wild carrot, rag weed and dog fennel.

Some of these weeds are annuals, some are biennials and some are perennials, and a knowledge of these distinctions enables the farmer to intelligently deal with the pests. Take, for example, the common burdock; it is a biennial—that is, it grows from the seed, and the first year it grows large leaves but does not throw out any seed stalk; the second year it goes to seed, and its burs containing the numerous seed pods will stick to live stock. Did any of you ever see sticking to stock these burs to be thrashed out in the pastures and over the farm, thus scattering the seed? Now, during the first year's growth of a burdock there is no use to cut it—in fact, it does more harm than good; but the second year, when it sends forth its seed stalk, just before it blossoms, cut it down in the vigor of its evil existence, and it will be dead forever. On the other hand, the yellow dock is a perennial, like timothy, and is a very mean weed. Its seeds do not spread so easily, but cutting it off does not kill it. It should be dug up, root and branch, and cast into the fire, that its seed may perish from off the earth.

Some weeds, especially annuals or biennials, may be killed by mowing them just before, or at the time, they blossom; but there are other weeds which cannot be killed by mowing after they are in bloom—for example, the Canada thistle will mature its seed even though it is cut down immediately after it has blossomed, as there is enough substance in the stalk to mature the seed.

The wild lettuce you all know very well, though the acquaintance is somewhat brief and disagreeable. It is a biennial, sometimes annual. It came to this country from Europe; its seeds are lighter and carried more easily than the thistle; it is a hardy plant and should be pulled out by the roots. The stem, close to the ground, is prickly and cannot be pulled without a covering on the hand. It is most troublesome in meadows; sheep will eat it and keep it in check in pastures. A full grown plant will produce about ten thousand seeds. There is a fungus which comes with this weed which will attack cultivated lettuce. When cut near the ground it will send up additional sprouts which will go to seed.

The Russian thistle first appeared in Dakota in 1873, and is now found over the greater part of the State. In some places the fields have been abandoned. It was first noticed in Ohio in 1894 along the tracks of the Lake Shore Railroad, near Bryan. It is one of the worst weeds known, and a large portion of Europe is afflicted with it. It is an annual and should be cut down when it first blooms, for one plant will produce about twenty thousand seeds.

The Canada thistle grows about two feet high; has prickly leaves, rose purple flower, and is the lightest colored of all thistles. It has the power of reproducing itself from roots as well as seeds. It is a perennial plant, and therefore more troublesome than either the wild lettuce or the Russian thistle. It is often shipped from place to place in baled hay. It originally grew in Europe and not in Canada, but it reached this country from Europe through Canada. It is more common in Canada than in the United States. While it is more difficult to suppress than the Russian thistle, the Russian thistle is much more injurious. The better way is to never permit this pest to mature on the farm. After it or any other weed once obtains a foothold, the labor multiplies many times to suppress it.

Wild and black mustard are annuals—that is, they produce seed each year. The plants themselves die, and the following year the seed will grow and mature seed. After the ground has become full of this seed, the successful way to treat them is to mow each year, just as they bloom. If this be done for two or three years, the plants can be destroyed. But if the plants be growing in a meadow, they will mature seed before the grass is ready to cut, so that such fields should be pastured or cultivated.

Purslane you are all acquainted with, from its fleshy leaves and stems. It is a creeping plant, but can mature more seed to each plant than any other known plant. It is estimated that one plant will bring forth a million seeds, and it may be very troublesome when the ground becomes thoroughly seeded to it. The way to kill it is to cut off when it has reached a mature size, and before it has produced seed, and turn it to the sun. It is an annual, growing each year from the seed.

Stick weed or beggar's lice are troublesome little seeds that will stick to animals and especially to the wool of sheep, but are easily suppressed if mown during their growth. Bracted plantain is a plant that grows annually from the seed, and may therefore be suppressed. The buffalo bur you are no doubt all familiar with, and it is easily suppressed, provided the plant be cut off before it goes to seed. It is an annual, and will not reproduce itself from the roots. Wild carrot is a very bad weed, and if there be but little of it, it should be dug up by the roots, and always, of course, mowed just at or before the time it blooms. It is a biennial. Rag weed is the most common weed in this country, and the best time to suppress it is when there is plenty of moisture to germinate all the seed; then mow off the weeds before the seed can mature; rake them up and let them rot, as they contain a good deal of fertilizing material.

The Spanish needle is an annual and may be suppressed by mowing before the seed can mature. It is a very troublesome plant and should be suppressed.

Much injury was done to the wheat last year because of the rag weed, there being so much rain that when the wheat was thrashed, the rag weed being wet caused some of the wheat to spoil, whereas, had there been no rag weed with the wheat, it would have dried out, so as to have done no injury. Thus thousands of dollars were lost to the farmers of Allen County alone because of the rag weed. It is an annual. The roots never reproduce; therefore mowing the ground, or cultivating it for two or three years, will destroy most of the seed. If the ground is thickly sodded, it will choke out the rag weed, but the seed will retain vitality for some length of time, so that when the meadow is broken up the rag weed will again appear. There are many other weeds that might be mentioned, but the same rule applies to the manner of suppressing them.

One of the greatest items of cost in the production of a crop is for labor expended in the extermination of weeds in order to give the crops a chance. If there were no weeds produced from the soil, the later cultivation of the crop would not be necessary. The value of the field crops in the United States for the year 1894, including wheat, corn, oats, rye, barley, buckwheat, tobacco, potatoes and hay, was one billion, six hundred and thirty million, eight hundred and seventy-three thousand, seven hundred and ninety-five dollars. Direct loss to machinery and stock and decrease in value of crops by reason of weeds amounted to ten million dollars.

*By Hon. J. D. Cable, in Annual Report of Ohio Farmers' Institutes.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR FENDER.—James K. Young, Meriden, Conn. This fender is a pivotally mounted frame having forward wheels which travel on the car track when the fender is down in operative position, and a portion of the fender is arranged to move forward when a person is caught upon it, thus holding one on the fender instead of throwing him in a way which might be dangerous to life or limb. The fender is readily attached to or removed from a car, and may be conveniently folded up against the dashboard if desired.

TRACK BRAKE.—Jefferson U. Elwood, McKeesport, Pa. This invention covers an improvement on two formerly patented inventions of the same inventor, and provides a shoe for track brakes of greater holding power than the ordinary shoe, and a more efficient mechanism for applying power to the shoe. The shoe has dovetailed or inwardly expanding recesses in its under surface, the recesses being filled with moulded blocks arranged to have a higher frictional resistance than the body of the shoe, and the operating mechanism comprises a worm and worm gear to which a grooved cam of decreasing radius is attached, giving great power in the application of the brake, by a movement which is rapid in the beginning, but slower and with increased power at a later portion of the application.

Electrical.

POWER TRANSMISSION. — Emil Lanhoffer, Mulhausen, Germany. This invention relates to systems in which the motors may be capable, within wide limits, of gradually altering their rotary speed, instead of a step-by-step variation, the electrical connections being also so arranged that the size of the motors will be reduced to a minimum for high running efficiency. A regulating device is provided for the armature comprising a plurality of circuits whose potentials are to each other approximately as the terms of a geometric progression, in combination with another operatively connected regulating device comprising a plurality of resistances arranged in series to control the intensity of the field, whereby the variation of intensity will be approximately the same for all differences of potentials.

Bicycles, Etc.

A MUSICAL ALARM SIGNAL.—Rudolf Hartmann, Alfred Hartmann and George F. Reinhard, Jersey City, N. J. From a hanger loosely mounted on the head, according to this invention, two trumpets are pivotally supported over the front wheel, there being in each trumpet one or more reeds, each supported on a diaphragm, and a piston being arranged to have movement in each trumpet by means of cranks on a small grooved wheel which is brought into contact with the front wheel of the bicycle when the rider presses down on a handle or push bar attached to the handle bar. Any instrument of a musical type to be operated by the compression or exhaustion of air may be used instead of the trumpets, making the tones of an organ pipe or reed, or a whistle, or their equivalents.

Agricultural.

REAPING MACHINE. — Mihail Alexandrescu, Bucharest, Roumania. A machine to be propelled by hand, instead of being drawn by draught animals, is provided by this invention, and consists of a frame mounted on two wheels, with a cutter on its forward end to be operated by a connection with the axle, while an endless apron carries the stalks which are cut to a rack, where they accumulate in quantities corresponding to sheaves, when they are pushed off to be bound by hand. The knife bar carries three-sided blades, and has a reciprocating motion, being brought down to the proper distance from the ground by raising the rear end of the frame by the handles on which the operator pushes.

Mechanical.

BELT APPLYING DEVICE.—Fordyce A. Savage and Milan G. Wade, Dowagiac, Mich. To facilitate putting belts on pulleys, drums, etc., these inventors provide a simple form of adjustable clamping device to engage the periphery of the pulley and project to one side, where it engages one side of the belt, lifting the belt and turning it upon the pulley, after which the device drops from the pulley, as the latter makes a half revolution, bringing the device from beneath the belt. The device is made in two sections adapted to slide upon each other, so that it may be used on all sizes of pulleys.

PLUMB AND LEVEL, ETC.—Edward D. Beatty, Louisville, Ky. This invention affords a combination of a plumb and level with an ordinary folding rule, which may be conveniently carried in the pocket. A level glass with a suitable amount of liquid is held in a casing which is connected with the rule by a link, so that it may be made to rest on the side of the rule when the latter is in horizontal position for use as a level, or on the end of the rule when the latter is to be employed as a plumb, the casing being of a length equaling only the width of two members of the rule.

Miscellaneous.

COMPUTING SCALE BEAM.—William R. Dunn, Alton, Ind. A hollow weighing beam, according to this invention, has graduations to indicate units of weights, and located within this beam is a price indicating beam having suitable graduations, two weights being movable along the hollow weighing beam and adapted for joint or independent use to indicate the weight and the price at the same time. The improvement is designed especially to simplify the construction as well as to render less expensive scales of this description, adapting them also for convenient use for a wider variety of articles.

THEATER CHAIR MIRROR. — Samuel Walker, Brooklyn, N. Y. An attachment for mirrors is provided by this invention for use with any upright or nearly upright support, the mirror with its fixed housing or casing being adjustable and movable and being normally concealed and protected. A shifting device is arranged to be operated by the foot in such manner as to slide the mirror out from its casing and hold it in exposed position as desired, leaving the hands entirely free, so that one facing the mirror may have a perfect view of the head and upper portion of the body without elevating the mirror above the top of the chair to which it is applied.

STOVE GRATE. — Edmund E. Flint, Tonawanda, N. Y. This is a grate for coal stoves which virtually constitutes an extension of the fire pot, and is so made that when shaken it grinds the cinders that may be between the sections, throwing out slate from its marginal portions, thus preventing the portion of the grate through which ashes pass from becoming clogged, and also promoting the draught. The grate is made with a pan section and a rim section, both provided with teeth, and each having movement in the same horizontal plane, one below the other, but the two sections moving in opposite directions, and one section moving faster than the other.

BANDAGE CUTTING MACHINE.—John R. Volz, New York City. A machine adapted to cut several strips of varying widths at one time, and capable of different adjustments to regulate the tension of the material while being cut, forms the subject of this patent. The machine comprises a suitable frame in which are journaled various shafts to rotate in unison, the driving shaft being turned by a handle on a pulley, from which is driven a cutter shaft and two winding shafts, the latter shafts being slidably mounted. The machine is of simple construction and easy to operate.

GARMENT CLASP.—Joseph Stern, New Orleans, La. This is a device more especially designed for use on the opening flaps of trousers, and permits of conveniently fastening the staple in place without stitching. A hook and a staple, each made of a single piece of sheet metal, are secured to the two flaps, the metal of the staple being bent upon itself to form two members, one having at its free end a pointed tongue to engage an opening in the end of the other member after it has been passed through the cloth.

A FISH NET NEEDLE AND WINDER.—George W. Raymond, Warrenton, Oregon. In needles for knitting fish nets and machines for winding twine on the needles, this inventor provides a needle having jaws or points at one end and means for regulating the space between the points of the jaws, while the winder comprises a rotary shaft to rotate the needle on a post which may be clamped to a table, and a spreader plate to open the points of the needle, the spreader plate having an eye for the passage of the twine.

VEHICLE ROLLER BEARING.—John R. Richardson, Madera, Cal. For the hub bearings of vehicles designed to carry heavy loads, this invention provides a bearing which extends the length of the spindle portion in order that the weight may be borne uniformly through the whole of such portion, to prevent the breaking down or crushing of the rollers or the boxing or spindle. It consists of rollers which bear for their full length between the box and spindle, there being a collar at each end of the box, and fitted to the collars are separate plates having projections which extend between the rollers at the ends.

PRISON CELL, VAULT, ETC. — Frank Peterhansl, Brooklyn, N. Y., and George H. Rothmann, Rutherford, N. J. The door, window grating or wall of a cell or vault, according to this invention, is composed of a network of connected pipes adapted to be connected to an exhaust device, this system being connected with a pipe leading to a central office, where an alarm valve is held on the pipe and closed by atmospheric pressure or adapted to be opened by a spring, sounding an alarm. A connected indicating disk also makes a corresponding alarm, giving the number of the cell, when a break has been made, destroying the vacuum in any of the pipes, the improvement being applicable to treasure vaults as well as prison cells, etc.

POST HOLE DIGGER. — Hugh L. T. Overbey, Summerville, Ga. This device has a lower cutting cylinder with internally beveled bottom cutting edge, and longitudinal slots in its side walls, and at the upper end of the cylinder is a hollow shank in which is secured the handle. A spring-pressed push plate is held movably in the cylinder, there being a foot piece for moving the push plate outward to remove the dirt taken up by the cylinder, the push plate returning to its normal position on removing the foot pressure, and not interfering in the least with driving the cylinder down into the ground.

FRUIT CLEANER. — Alexander Chambers, Newtown, Pa. For cleaning currants, raisins, dried apples, prunes, etc., this machine consists of a frame in which rails are arranged on an incline to support a slidable screen, conveniently adjustable in relation to a brush, the parts being so arranged that the brush and screen may be readily removed, and means being provided for the proper breaking up of the lumps before the fruit is acted on by the brushes. Screens of different mesh are provided for various kinds and sizes of fruit.

BAG TIE.—Albert Davison, Belvidere, Ill. A simple, easily operated fastener, which can be cheaply made and applied without injury to the bag, is provided by this invention. It comprises a plate section and a stud section, the latter having a hooklike main tongue and opposite guide and retaining tongues, the latter being deflected to form a hump. Means are provided for detachably connecting the plate section and the stud section, a cord or line of twisted wire being used in connection with the device.

BAG FASTENER. — Newell F. Wightman, Meriden, Conn. This invention relates to metallic fasteners for grain bags, and comprises a fastener made of two pivoted sections, an inwardly extending tooth on each section, a ratchet toothed arm on one section and on the other section a boxing having an opening for the passage of the arm. A block is adapted to engage the arm, a stem extending from the block through the end wall of the boxing, a spring surrounding the stem, on the outer end of which is a finger piece. The fastening maintains a substantially circular form and position, and will not slip from the bag.

HUB ATTACHING DEVICE —Simon J. Harry, Washington, D. C. The axle, according to this improvement, comprises a spindle with a threaded stem and a non-circular seat at its inner end, on which is fitted

© 1897 SCIENTIFIC AMERICAN, INC.

a collar having in its outer side a recess to receive a spring pawl, while the nut has a flange on whose inner side is a notch forming a seat for the pawl, there being an opening through the flange for the insertion of an instrument to release the pawl. The device affords means for preventing the turning of the cap nut, and, the pawl being countersunk, the nut may be turned close up against the collar.

PUMP.—James A. Fink, Russell Springs, Kansas. This pump presents a novel construction of reciprocating water tubes and cylinders, and intermediate connections between them designed to counteract or compensate for the momentum of the pipes and the water they contain when the pump is being operated, as well as their inertia at the start of each stroke. The arrangement is such as to give to the stroke of the plunger in the cylinder double the stroke given by the lever of the pump.

AIR SHIP.—Thomas M. Crepar, Grand Rapids, Minn. This flying machine has elongated upper and lower balloon sections, connected by a hanger band and cordage, there being on each side of the lower shell aeroplanes, while projecting upwardly from its bottom in the interior is a cabin, below which is a power room and propelling and controlling devices. A main propeller wheel and rudder are located at the rear of the lower shell, and two smaller propellers beneath it.

RAZOR GUARD. — Howell T. Fisher, Pottsville, Pa. This is an extremely simple and inexpensive device adapted for convenient attachment to and adjustment on either side of a razor blade, to render self-shaving easy and safe. It consists of a guard bar having an upwardly extending slotted portion with which is adjustably connected a clamping device adapted to engage the back of the razor, the lower edge of the guard bar being thus readily adjusted vertically and lengthwise along the cutting edge of the razor. It is applicable to any style of razor.

HOLDER FOR CALENDARS, ETC.—Hugh Brown, Ann Arbor, Mich. This invention provides a holder consisting of a casing with opening in its back, and provided with a keeper, a spring-retaining device, a tongue adjustably connected with the back of the casing, and other novel features, the device being well adapted to hold the sheets of a calendar or teachers' class records, lists of words or other matters to be kept in a certain order and in convenient shape. It also provides a ready means for preserving past records or memoranda for consultation without interfering with current matters.

SHOE STOOL.—Charles J. Sawyer and Thomas F. Harris, Anniston, Ala. This stool comprises a stand at one end of which is a seat for a salesman or fitter, while at its other end is a fixed heel rest and a spring plate for the shoe sole to rest on, there being means for guiding the free end of the spring plate. The improvement is designed to facilitate the proper fitting of a shoe on the foot of a customer in shoe stores.

MANHOLE AND COVER.—John T. Cullen, Clinton, Iowa. To increase the strength of a boiler head and prevent leakage by forming a steamtight joint, according to this invention, the manhole is made with an annular marginal recess on its inner face, in which fits an annular marginal ridge of the cover, which is secured in place by outwardly extending bolts, threaded at their outer ends and held by nuts in screw-threaded apertures of yokes whose ends rest on the marginal bead of the manhole.

BURIAL CASKET.—Charles A. Ruebekam, Owosso, Mich. The covers or lids of the casket, around that portion at which the face of the occupant is to be exposed, according to this invention, are so constructed that their position may be readily changed to expose more or less of the person, the keepers for the covers, also, being hardly discernible in the moulding, and provision being made for the entire removal of the covers when required.

Designs.

HAT SUPPORT.—Harriette G. Cozzino, New York City. This invention is for a hat and garment support more especially designed for theater chairs, and consists of a body adapted for application to the back of a chair, and a front member with which a mirror is pivotally connected, the device not only serving as a rack, but facilitating the rearrangement of one's toilet.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

THE FLOODS OF THE MISSISSIPPI RIVER. Including an account of their principal causes and effects, and a description of the levee system and other means proposed and tried for the control of the river, with a particular account of the great flood of 1897. By William Starling. New York: The Engineering News Publishing Company. 1897. Pp. 57. Price 50 cents.

The author of this book is a civil engineer of reputation and has held for many years the position of chief engineer of the Lower Yazoo levee district, and is, therefore, specially competent to discuss the subject on which he writes. The work will be of no small public benefit in disseminating a higher knowledge of the conditions which confront the dwellers in the Lower Mississippi.

A DESCRIPTIVE CATALOGUE OF USEFUL FIBER PLANTS OF THE WORLD. Including the structural and economic classifications of fibers. By Charles Richards Dodge. Washington: United States Department of Agriculture. 1897. Pp. 361.

The fiber investigations of the Department of Agriculture have been recognized as of the utmost importance, and the present descriptive catalogue of useful fiber plants is one of the most creditable books which has been issued by the Department of Agriculture. The Dodge pamphlets on fibers are of acknowledged authority and the present work admirably supplements them. The fibers are arranged in alphabetical order and the monograph has 108 illustrations and 11 plates.

We have received the "Marine Number" of Cassier's Magazine. It is one of the finest specimens of scientific and technical journalism we have ever seen. It consists of more than 300 reading pages, which are embellished with beautiful engravings, largely half tones, which are almost uniformly good. The entire number is printed on coated paper, bringing out the finest detail of the engravings. The reading matter is contributed by specialists, which include Sir William Henry White, A. F. Yarrow, Robert Caird, John U. Thornycroft, Sir Charles W. Dilke, John P. Holland, and others. We have no hesitation in commending this splendid number most heartily to all who are in any way interested in naval engineering. The price is 50 cents.

We have received the new 1897 "Circular of Information" of the International Correspondence School, of Scranton, Pa. This catalogue gives an excellent idea of the work which has been done by the students and the courses which they may take. Education by correspondence is now an assured success, and no student, even in far away country towns, need now be cut off from educational opportunities by reason of his isolation. It is a curious fact that the students of the International Correspondence Schools come from 45 different countries. For instance, there are 22 students in Japan and 17 in the South African republics. The new prospectus is very well calculated to give the reader the salient features of the system.

SCIENTIFIC AMERICAN BUILDING EDITION

SEPTEMBER, 1897.—(No. 143.)

TABLE OF CONTENTS.

No. 1. Plate in colors, also another perspective elevation and floor plans of a residence at Bensonhurst, L. I., recently erected for Mr. Walter Jones. A design treated in an attractive style of architecture, with Colonial feeling and classic detail. Architect and builder, Mr. Walter Jones.

No. 2. A Colonial residence at Springfield, Mass., recently completed for Mr. N. N. Fowler, at a cost of $13,000 complete. Two perspective elevations and floor plans. Mr. Guy Kirkham, architect, Springfield, Mass.

No. 3. Residence at Scranton, Pa., recently erected for Mr. Thomas R. Brooks. A unique design. Two perspective elevations and floor plans. Mr. John A. Duckworth, architect, Scranton, Pa.

No. 4. Elm Park Methodist Episcopal church and parsonage at Scranton, Pa. Two perspective elevations and floor plans, also two perspective elevations of the parsonage, with floor plans. Architects, Messrs. George W. Kramer & Co., New York City.

No. 5. English dwelling at Overbrook, Pa., recently erected for Mr. Smucker. An attractive design treated in the English style, half timber and stone. Perspective elevation and floor plans, also interior view. Architect, Mr. William L. Price, Philadelphia, Pa.

No. 6. Cottage at Binghamton, N. Y., recently erected for Mr. G. N. North, at a cost of $3,200. Two perspective elevations and floor plans. A design with many excellent features, good elevations and well arranged plans. Mr. Elfred Bartoo, architect, Binghamton, N. Y.

No. 7. Modern cottage at Nyack, N. Y., recently erected for the Rev. Edward Mitchell, at a cost of $2,500 complete. Two perspective elevations and floor plans. A unique design for small cottage. Mr. George F. Morse, architect, Nyack, N. Y.

No. 8. Modern suburban villa at Chestnut Hill, Mass., erected for Messrs. Merriam, Isbenbeck & Alvord. A design well treated in the modern American style with Colonial detail. Two perspective elevations and floor plans. Architect, Mr. J. H. Morse, Boston, Mass.

No. 9. A residence at Binghamton, N. Y., recently erected for Miss Q. M. French. Perspective elevation and floor plans. A very attractive design with excellent elevations.

No. 10. An actress' home at Chevy Chase, Md., illustrating the residence of Miss Annie Lewis. Two perspective elevations and floor plans. Mr. Louis D. Meline, architect, Chevy Chase, Md.

No. 11. Half page design of the New Rathsapotheke in Bremen.

No. 12. Pulpit of the Cathedral of Sainte Gudule, Brussels.

No. 13. Miscellaneous Contents: New York as a furniture market.—Advantages of fresh air in apartments.—Exterior plaster for dwellings.—Rules for making good mortar.—Premature occupation of new homes; a test for relative humidity of habitable apartments.—Ventilation of apartments.—Does your faucet leak?—A new recording thermometer, illustrated.—Beautiful work in wood finishing.—Slate roofs.—Dec-co-re-o, illustrated.—Berkfeld filter, illustrated.

The Scientific American Building Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates and fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects. All who contemplate building, or improving homes or structures of any kind, have in this handsome work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

The Fullness, Richness, Cheapness and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural Publication in the world. Sold by all newsdealers. MUNN & CO., PUBLISHERS, 361 Broadway, New York.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Combined Ink, Pen, and Penholder Carrier. Patent for sale. M. Scougale, Fort Worth, Texas.

Improved Bicycle Machinery of every description. The Garvin Machine Co., Spring and Varick Sts., N. Y.

Concrete Houses — cheaper than brick, superior to stone. "Ransome," 757 Monadnock Block, Chicago.

For static machines for all purposes, and X ray apparatus, write Reedsburg Electric Mfg. Co., Reedsburg, Wis., U. S. A

The Norwich Line—New York to Worcester, Lowell, Gardner, Winchendon and Keene, N. H. From Pier 40, North River, 5:30 P. M., week days only.

Machinery manufacturers, attention! Concrete and mortar mixing mills. Exclusive rights for sale. "Ransome," 757 Monadnock Block, Chicago.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7204) E. T. H. writes: The SUPPLEMENT containing description of Æolian harps (No. 483) which you sent me is at hand. Will you kindly inform me through your Notes and Queries the best strings to use in the construction of the Frost & Kastner improved harp described on page 7715 of that number? The article simply says catgut. Is small, as the E string of a guitar, or heavy, as F of the same instrument, preferable? Also which gives the more desirable tone—the harp with strings tuned all in unison or to the octave? A. The strings of an Æolian harp are usually of fine catgut, tuned in unison, and of equal length. The varying force of the air causes them to divide into segments, and thus to produce the tones of the harmonic series. It is doubtful if the wind could start a string coarse enough to make a tone an octave below, or one strained tight enough to produce the octave above. It is, however, an experiment easily tried by our correspondent.

(7205) G. K. P. asks: How much spark and how many ounces of wire will it take to make an induction coil the same size of illustration in SUPPLEMENT, No. 160, which you say is one-half size of directions given? A. From ¼ to ⅛ as much wire in secondary. If you reduce core and primary coil in proportion, you will probably obtain ⅜ as long a spark with the same battery power.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

AUGUST 31, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Air brake alarm cock, A. McIntosh ... 589,265
Air compressing apparatus, E. C. Nichols ... 589,190
Alarm. See Electric alarm. Fire alarm.
Ashes, receptacle for holding tobacco, F. R. Baker ... 589,152
Awning, L. T. Hagan ... 589,257
Axle box dust guard, vehicle, J. Loesewitz ... 589,211
Axle box lid, N. H. Davis ... 588,960
Bake pan, covered, N. Strack ... 589,229
Baling press, Albrecht & Bitner ... 588,938
Basin clamp, H. Mueller ... 589,136
Batteries, automatic switch for charging or discharging secondary, A. S. Hubbard ... 589,128
Battery. See Storage battery.
Bearing, adjustable, E. J. Muller ... 589,137
Bearing for bicycles, dust proof ball, L. H. Cobb ... 589,204
Bed, G. W. Bent ... 589,239
Bedstead, A. E. Strang ... 589,316
Beer, method of and apparatus for treating, O. Zwietusch ... 589,065
Bell, bicycle, W. A. Penfield ... 589,220
Belt shifter, Fergusson & Kline ... 588,967
Bench. See Wash bench.
Bending machine, J. F. Doolittle ... 589,167
Bicycle, G. P. Ohlgart ... 589,394
Bicycle change gear, Nedland & Fredrickson ... 589,266
Bicycle construction, J. F. Black ... 589,240
Bicycle fastener, C. F. Carlson ... 589,336
Bicycle flagstaff holder, Koch & Rehm ... 589,261
Bicycle fork, L. Sturges ... 589,147
Bicycle frame, H. Cooper ... 589,205
Bicycle handle bar, A. F. Temple ... 589,045
Bicycle or tricycle attachment, H. Schneider ... 589,305
Bicycle propelling mechanism, I. W. Conselyea ... 588,955
Bicycle wheel, C. H. Gary ... 588,975
Billiard cue trimmer and tip fastener, C. Schoenleber ... 589,225
Binder and mower brake mechanism, C. H. Anspach ... 588,941
Blanks, etc., device for feeding, C. C. Freeman ... 589,335
Boat, sectional folding, A. J. Haggen ... 588,986
Boiler. See Steam boiler. Steam and hot water boiler.
Boiler tube cleaner, P. Hoerlein ... 589,126
Bonus determining device, A. Barnes ... 589,154
Bottle, G. V. Stallings ... 589,196
Bottle, D. J. Sweeney ... 589,044
Bottle cap, W. Polson ... 589,366
Bottle closure, M. Altstaedter ... 588,939
Bottle, non-refillable, W. P. Bliss ... 588,947
Bottle, non-refillable, Coates & Schutz ... 589,164
Bottle, non-refillable, J. Fultz ... 589,207
Bottle, non-refillable, G. W. Scott ... 589,035
Bottle washer, H. H. Miller ... 589,135
Box. See Folding box. Letter box. Match box.
Box attachment, J. H. Morlan ... 589,188
Brake. See Vehicle brake. Velocipede brake.
Brake beam, J. Player ... 589,269, 589,270
Branding machine, J. Ingle ... 589,087
Broom head, W. T. Watts ... 589,052
Brush or mop holder, P. H. Humbach ... 589,351
Brush, scrubbing, B. F. C. Grimes ... 589,171
Buggy top attachment, W. O. Wilbur ... 589,324
Bung branding machine, J. F. Theurer ... 589,231
Burner. See Incandescent burner.
Button, B. H. Cook ... 588,956
Cabinet, ticket or label, A. F. McIntyre ... 589,016
Calcining or roasting furnace, F. Brandenburg ... 588,949
Camera, kinetographic, T. A. Edison ... 589,168
Camera, magazine, E. E. Flora ... 589,346
Camera, photographic, L. J. R. Holst ... 589,349
Camera, photographic, S. Ritter ... 589,304
Can casing machine, J. P. Simmons ... 589,226
Car coupling, J. Miller ... 589,363
Car coupling, P. M. Reagan ... 589,140
Car coupling, W. B. Rice ... 589,027
Car door, grain, H. M. Tyrrell ... 589,198
Car, dumping, Cleek & Humphrey ... 588,953
Car, dumping, W. A. Smith ... 589,313
Car fender, H. Boom ... 589,156
Car fender or guard, A. Barnes ... 589,153
Car, railway, L. Moss ... 589,215
Car ventilating wind wheel, Robinson & Raher ... 589,195
Car wheel, Lewis & Stevenson ... 589,356
Carbonating apparatus, liquid, G. D. Rhinehart ... 589,371
Carbureter, J. Ormerod ... 589,094
Cardboard obliquely, machine for cutting, A. W. Darre ... 589,075
Carousel, R. M. Hunter ... 589,390
Carriage parasol holder, baby, J. A. Crandall ... 588,958
Carriage storm apron, A. F. Brandenburg ... 589,069
Cash register, F. H. Bickford ... 589,114
Cash register, T. Carney ... 589,245
Cash register, J. P. Cleal ... 589,246
Caster, G. E. Neuberth ... 589,217
Chain for sprocket wheels, G. W. Bufford ... 589,203
Chair. See Window chair.
Channel flap turner, W. E. Fischer ... 588,970
Check branding apparatus, E. E. Angell ... 588,940
Chimney sweeper, G. W. Middleton ... 589,012
Cigarette machine, J. A. Bonsack ... 589,116
Cigarette machine, continuous, K. H. Carper ... 589,121
Clamp. See Basin clamp.
Cleaner. See Boiler tube cleaner. Flue cleaner. Tooth cleaner.
Clipper, hair, G. H. Coates ... 588,954
Clothes line support, T. T. Parker ... 589,023
Clothes pounder, W. P. Rylander ... 589,399
Clutch, sprocket wheel, J. & H. M. Copeland ... 589,338
Coating metals, W. Banfield ... 589,381
Coffee or tea pot, A. Macy ... 589,005
Colter and scraper for cotton cultivators, adjustable, H. W. Smith ... 589,311
Combination knife, A. R. Kolar ... 589,392
Combination lock, C. A. Bailey ... 589,327
Cot, trunk, J. B. Gossman ... 588,979
Coupling. See Car coupling. Pipe coupling. Thill coupling.
Crucibles or lining of furnaces, brasquing of, P. E. Placet ... 589,221
Crusher and pulverizer, N. F. Williams ... 589,236
Crushing and grinding mill, W. H. Coward ... 589,248
Cultivator truck, O. Phinney ... 589,193
Cup and can, combined, C. P. Kertell ... 589,391
Curtain pole ring, Steinert & Babb ... 589,375
Curtain stretcher, W. A. Mayr ... 589,263
Cutter. See Pipe cutter. Thread cutter.
Cycle, T. Hill ... 589,348
Cycle saddle, J. B. Brooks ... 589,243
Cylinder drier, J. Hundhausen ... 589,352
Dental furnace, electric, C. A. Timme ... 589,048
Desk, J. P. L. Nelson ... 589,018
Desk light, A. H. Ryder ... 589,032
Digger. See Potato digger.
Disinfecting apparatus, R. Westphal ... 589,054
Distilling apparatus, H. J. Krebs ... 589,000
Door for poultry houses, T. N. Banner ... 589,111
Door stay, adjustable, Deplanty & Wilson ... 588,962
Door stop, J. E. Minott ... 589,264
Drawers, device for covering and protecting contents of, H. R. Burt ... 589,159
Drier. See Cylinder drier.
Drill and oyster dredge, combined, T. Thomas ... 589,047
Drilling apparatus, T. L. Armstrong ... 589,110
Duplicating pad or sheet, H. P. Brown ... 589,372
Dynamite heater, G. Rickert ... 589,029
Dynamo brush, F. J. Chaplin ... 589,162
Dynamos, electric regulator for, W. H. Chapman ... 589,073
Educational appliance, J. M. Lamb ... 589,180
Electric alarm and call bell, F. C. Jordan ... 588,997
Electric car lighting system, F. M. Bennett ... 589,112
Electric meter, E. J. King ... 588,999
Electrical body appliance, J. P. McGill ... 589,015
Engine. See Fluid pressure engine. Gas engine. Rotary engine.
Engine indicators, reducing mechanism for steam, A. C. Lippincott ... 589,358
Envelope, J. C. Griffith ... 588,965
Envelope safety device, C. H. Brown ... 589,158
Evaporator, H. A. Merriam ... 589,091
Extension table, Haynes & Lapham ... 589,388
Fanning mill, W. F. Frambach ... 588,972
Fastening device, W. H. Bomm ... 589,333
Feed water heater, J. Pimbley ... 589,364
Feed water regulator, R. Berg ... 589,113
Feeding and watering device, poultry, S. D. Strong ... 589,230
Fence machine, wire and picket, B. L. Coutant ... 589,165
Fence post, D. Vaniman ... 589,320
Fender. See Car fender.
Ferrule for tool handles, J. Swan ... 589,043
File cutting machine, J. Turner ... 589,232
Filter, J. A. Mullen ... 589,189
Filter, water, W. P. Robertson ... 589,223
Fire alarm, J. W. Arnold ... 588,942
Firearm, automatic magazine, A. Burgess ... 589,118
Firearm, gas operated, A. Burgess ... 589,119, 589,120
Firearm, magazine, A. Burgess ... 589,117
Firearms, locking means for operating levers of, T. G. Bennett ... 589,201
Fire extinguisher, B. S. Brown ... 589,202
Fire plug frost jacket, J. Link ... 589,357
Fire shield, W. J. Woodruff ... 589,062
Fires, extinguishing, F. Cantore ... 589,244
Flue cleaner, H. W. Hubbard ... 589,086
Fluid pressure engine, W. H. Knight ... 589,354
Fluid pressure motor, W. H. Knight ... 589,355
Folding box, satchel, valise, trunk, etc., J. G. Garcis ... 589,208
Folding machine, A. Blomfeldt ... 589,068
Folding machine, F. Hart ... 589,083
Food articles from milk, preparing, A. Bernstein ... 589,155
Fruit cleaning and assorting machine, W. P. & H. Rice ... 589,141
Fruit picker, J. H. Martindale ... 589,009
Furnace. See Calcining or roasting furnace. Dental furnace. Smelting and refining furnace.
Gage. See Water gage.
Garbage incinerating apparatus, J. J. Kennedy ... 588,998
Garment supporter, Sueppel & Kenney ... 589,317
Garment, union, J. L. Boyer ... 589,241
Gas apparatus, J. W. Ogden ... 589,219
Gas burner chimney, incandescent, E. M. White ... 589,322, 589,323
Gas burner tip, acetylene, E. J. Dolan ... 589,342
Gas engine, J. C. Wilson ... 589,150
Gas incandescent, R. Moscheles ... 589,393
Gas lights, manufacture of mantles for incandescent, K. Trobach ... 589,376
Gate, J. B. Miesse ... 589,134
Gear, sprocket, T. S. Brown ... 588,950
Generators and storage batteries in conjunction, means for operating, Meredith & Hunt ... 589,186
Ginning machine attachment, N. R. Coursey ... 589,339
Glass cutting apparatus, J. W. Seiter ... 589,308
Governor, S. J. Tutthill ... 589,378
Governor, gas engine, R. Caldwell ... 589,335
Governor, marine engine, W. G. Hannah ... 589,172
Grading and scraping machine, J. Heuermann ... 588,992
Grain binder tension device, M. L. Pratt ... 589,222

(Continued on page 174)

© 1897 SCIENTIFIC AMERICAN, INC.

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

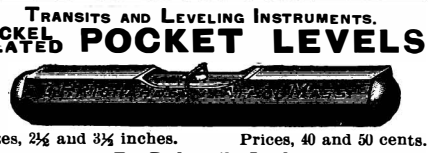
WOOD or METAL WORKERS
without steam power can save *time* and *money* by using our
Foot and Hand Power Machinery
SEND FOR CATALOGUES—
A—Wood-working Machinery.
B—Lathes, etc.
SENECA FALLS MFG. COMPANY,
695 Water St., Seneca Falls, N. Y.

SCIENTIFIC AMERICAN SUPPLEMENT.—Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

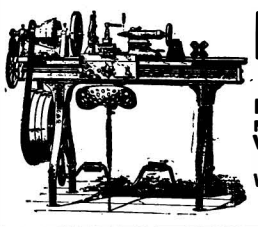
POWER & FOOT LATHES. SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE.
SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

Pipefitters!
Your kit is not complete unless it includes the famous
STILLSON WRENCH
which is particularly adapted for turning out the best work *without crushing the pipe* in the least. All parts are drop-forged. Once tried, it is always used. It has many imitations but no equals. See explanatory cuts. Price list on application to
WALWORTH MFG. CO., 20 Oliver Street, Boston, Mass.

TRANSITS AND LEVELING INSTRUMENTS.
NICKEL PLATED POCKET LEVELS



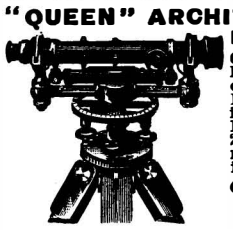
Sizes, 2½ and 3½ inches. Prices, 40 and 50 cents.
For Book on the Level.
C. F. RICHARDSON & SON,
P. O. Box 977, ATHOL, MASS., U. S. A.



LATHES
FOR
GUNSMITHS, TOOL MAKERS, EXPERIMENTAL AND REPAIR WORK, ETC.
Send for Illus. Catalog.
W. F. & Jno. Barnes Co.
1999 Ruby Street,
ROCKFORD, ILL.

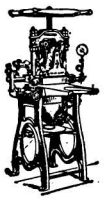
Eyelet Machines.
We can furnish the Latest Improved Eyelet Machines for making shoe eyelets and special eyelets of all descriptions. We are also builders and designers of Special Wireworking Machinery.
☞ *Send for Circular.*
BLAKE & JOHNSON,
P. O. Box 7, WATERBURY, CONN., U. S. A.

"QUEEN" ARCHITECT LEVEL $50
Improved Transits & Levels



Graduated entirely on our large dividing engines. Special award at the World's Fair. All kinds of Engineering, Surveying and Drafting Instruments and Materials. 220 p. illustrated catalogue mailed free only if this ad. is mentioned.
QUEEN & CO., Inc.,
1011 Chestnut St., Philadelphia.

DORMAN'S VULCANIZERS
are used all over the world.



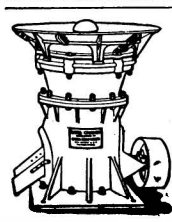
Exclusive Manufacturers of Steam Machines for Rubber Stamps. We also make Dry Heat Vulcanizers. Complete outfits from $10 to $1,000. All Stamp and Stencil Tools and Supplies. Brass and Steel Dies for all purposes. Seals, Engraving and Die Sinking of all kinds. Established 1860. Printing Presses, with complete outfits, from $1 to $100. ☞ *Send for Catalogues.*
THE J. F. W. DORMAN CO.
121 E. Fayette St., Baltimore, Md., U. S. A.

THE OBER LATHES

Patented.

For Turning Axe, Adze, Pick, Sledge, Hatchet, Hammer, Auger, File, Knife and Chisel Handles, Whiffletrees, Yokes, Spokes, Porch Spindles, Stair Balusters, Table and Chair Legs and other irregular work.
☞ *Send for Circular A.*
The Ober Lathe Co., Chagrin Falls, O., U. S. A.

CROOKES TUBES AND ROENTGEN'S Photography.—The new photography as performed by the use of Crookes tubes as a source of excitation. All about Crookes tubes. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **181, 189, 238, 243, 244, 792, 795, 905, 980, 1050, 1054, 1055, 1056, 1057,** also SCIENTIFIC AMERICAN, Nos. **7, 8, 10** and **14,** Vol. 74. These profusely illustrated SUPPLEMENTS contain a most exhaustive series of articles on Crookes tubes and the experiments performed with them. Among them will be found Prof. Crookes' early lectures, detailing very fully the experiments which so excited the world and which are now again exciting attention in connection with Roentgen's photography. Price 10 cents each. To be had at this office and from all newsdealers.



GATES ROCK & ORE BREAKER, Steam Ore Stamp, Mining Machinery,
50 years experience as builders.
GATES IRON WORKS,
Dept. C, 660 Elston Ave., Chicago.

Grain transfer apparatus, F. J. Weber 589,106
Grass collector or gatherer, M. C. Richards 589,028
Grinding and polishing machine, F. Rudolphi 589,398
Ground lever switch, Moore & Fink 589,187
Hair straightener, R. E. Rhodes 589,397
Hammer, J. S. Kelly 589,178
Hammer, pneumatic, J. Moore 589,214
Hanger. See Paint pail hanger.
Harmonium, C. F. Von Bassus 589,066
Harness attachment, H. L. Steel 589,040
Harrow, C. S. Sharp 589,037
Harvesting machine, grain, C. P. Alling 589,380
Hat pin, L. A. Scott 589,145
Hay rake, A. Fournier 589,384
Headlight, electric, J. Kirby, Jr 589,130
Heat, transmitting, G. F. Dinsmore 589,340
Heater. See Dynamite heater. Feed water heater.
Heater, R. M. Hermance 589,085
Heating apparatus, gas, G. Schoonjans 589,306
Heel attaching machine, F. F. Raymond, 2d 589,396
Hoodwink, H. Seffer 589,307
Hook. See Lacing hook. Whiffletree hook.
Hopple, L. Carr 589,071
Horse checking device, F. X. Lussier 589,181
Horseshoe, D. S. Jaffray 589,129
Horseshoe guard, D. R. Porter 589,095
Hose fitting, A. McKee 589,216
Humidifier, H. J. Barnes 588,944
Ice tool, Field & Shedd 589,254
Incandescent burner, J. H. Dubrow 589,343
Insulating material, making, Gray & Case 589,256
Jack for turning flywheels of engines, etc., J. S. Roberts 589,031
Jar. See Milk jar.
Jar closure, C. S. Alden 589,151
Joint. See Rail joint.
Kettle, dinner, W. MacCallum 589,360
Key seat cutting machine, W. Merrill 589,010, 589,011
Kite string traveler, Folsom & Packard 589,373
Kneading machine, dough, L. Durand 589,250
Knife. See Combination knife.
Knitting machine fashioning mechanism, L. C. Huse 589,174
Knitting machine needle, G. E. Philbrick 589,024
Knob locking device, Oetjen & Fourcher 589,021
Lace fastener, R. R. T. Grant 588,981
Lacing hook and eyelet, combination, R. C. Pleins 589,395
Ladder, extension step, T. W. Alexander 589,326
Lamp, G. Washington 589,051
Lamp, acetylene gas generating, F. Rhind 589,098, 589,099
Lamp heater frame, R. C. White 589,056
Lantern, tubular or hurricane, W. Batdorff 588,945
Lantern, tubular or hurricane, J. Wock 589,060, 589,061
Lap ring, W. G. Gatewood 588,976
Last heel shaping machine, A. G. Fitz 588,971
Lathe, double turreted chucking, G. G. Prentice 589,138
Leather glazing and pebbling machine. C. A. Southwick 589,103
Letter box, street, J. N. Clouse 589,074
Life raft, L. H. Raymond 589,139
Light. See Desk light. Headlight.
Lock. See Combination lock.
Match box, A. W. Warnock 589,050
Match machine, B. T. Steber 589,315
Match safe, G. Fortescue 589,206
Measuring and cost indicating apparatus, combined, A. Smith 589,310
Measuring machine, cloth, E. T. Butler 589,160
Metals by electrolysis, apparatus for refining, J. O. S. Elmore 589,251, 589,252
Meter. See Electric meter.
Milk jar and tester combined, L. E. Brown 589,382
Mill. See Crushing and grinding mill. Fanning mill. Muller mill.
Mould. See Suppository mould.
Morocco glassing machine, E. T. Ems 589,123
Motor. See Fluid pressure motor. Tidal motor.
Motor, H. H. Vaughan 589,105
Motor worked by hydrocarbon or other gases, C. T. Wordsworth et al 589,108
Mowing or reaping machine sickle, W. Brenton 589,157
Muller mill, centrifugal, C. E. Seymour 589,036
Nail puller, T. F. Stevenson 589,041
Nipple, J. C. Michael 589,212
Noodle machine, P. Warner 589,049
Nut lock, G. Millen 589,013
Nut lock, Skiles & Maust 589,309
Oil press box, J. H. Hubbell 589,389
Oven, I. Kinsey 589,090
Pad. See Duplicating pad.
Paint pail hanger, J. L. Isbell 589,088
Pan. See Bake pan.
Paper feeding machine, Womersley & Keating 589,107
Paper making machines, dandy roll for, J. Lister 589,131
Path delineating, recording, and measuring machine, J. Riddell 589,030
Pen, fountain, F. J. Pribyl 589,368
Phosphate and making same, J. E. Stead 589,197
Photographs, embossing, D. F. Hulbert 589,260
Piano, J. H. Block 589,331
Piano, electric, J. L. Fulkerson 589,347
Piano legato attachment, R. C. Schirmer 589,100
Picker. See Fruit picker.
Pile core, A. A. Raymond 589,026
Pillow or cushion, J. T. Cowley 588,957
Pin. See Hat pin.
Pipe. See Tobacco pipe.
Pipe and earthenware manufacturing machine, sewer, D. Spooner 589,104
Pipe coupling, J. S. Miles 589,362
Pipe cutter, W. Scholes 589,101
Pipe holder, H. S. Frost et al 588,974
Pipe wrench, D. A. Henderson 588,991
Pipe wrench, J. K. Sheffy 589,038
Pipes and electrical conduits, outlet box for gas, Billings & Mauer 589,115
Planter, J. E. Rausheck 589,096
Planter, corn, D. R. Vivion 589,321
Plow, R. Jones 589,374
Plow, H. O. Kruschke 589,179
Plow, R. H. Purnell 589,025
Plow controller, turn, C. Carnahan 589,337
Plow, swivel or hillside, W. L. Casaday 589,072
Pneumatic dispatch apparatus, L. G. Bostedo 588,948
Pneumatic seat support, P. J. Hindmarsh 588,993
Pole base, metal, G. W. Glazier 589,079
Pool and billiard table, convertible, A. M. Gerstle 588,961
Post. See Fence post.
Pot. See Coffee or tea pot.
Potato digger, C. Oehrlein 589,020
Pottery muffle or kiln, Hancock & Winzer 588,987
Press. See Baling press.
Pruning implement. D. C. Baker 588,943
Puller. See Nail puller.
Pulp strainer, D. N. Bertram 589,329
Pump, E. E. Johnson 588,995
Pump, diaphragm, G. F. Flodman 589,078
Puzzle, L. S. Markel 589,132
Quick action wrench, F. F. De Voe 589,166
Rail joint, W. Cooper 589,247
Rail joint, J. H. Johnson 589,175
Railway signal, C. W. Grant 589,170
Railway switch, R. Cady 588,951
Railway switch, automatic, L. A. Moore 589,093
Railway switch, street, J. F. E. Feltner 588,966
Railways, adjustable gage bar for, P. Olson 589,268
Rake. See Hay rake.
Ramie, machine for treating, A. Price 589,369
Razor, safety, W. Greenfield 589,080
Reamer, expanding, W. T. Beard 589,067
Refrigerator water cooler, F. H. Trumbull 589,377
Register. See Cash register.
Regulator. See Feed water regulator.
Ring. See Curtain pole ring. Lap ring.
Rope grip and takeup, J. Samuelson 589,224
Rotary engine, C. E. Duncan 589,076
Roving stop motion, E. H. Ryon 589,033
Rule, adjustable, F. Zika 589,064
Sandpapering or analogous machine, J. H. Manning 589,006
Sash holder, A. Lowry 589,359
Sash holder, T. Martin 589,361
Saw resawing machines, feed mechanism for band, F. McDonough 589,014
Saw set, H. Niedhardt 589,267
Sawing and grooving machine, swing, B. G. Luther 589,003
Sawing machine, swing, B. G. Luther 589,004
Scaffold, W. H. Gray 588,982
Scale, computing, J. E. Pitrat 589,365
Scale scraping device, W. M. Reed 589,370
Scale weighing machine, D. C. B. Griffith 589,081
Scraper, J. B. Crapp 588,959
Scraper for removing snow, etc., Field & Shedd 589,255
Screw machine, Sargent & Page 589,143, 589,144
Screw machine, automatic, G. E. Witherell 589,379
Scuttle cover, W. L. Springer 589,314
Sewing machine spool support. H. L. Webster 589,053
Sewing machines, friction driving pulley for, Dimond & Dial 588,963
Sewing or other machines, operating mechanism for, M. Freedman 588,973
Shade holder, M. D. Greengard 588,984
Shelving, portable, L. C. Tabb 589,318
Shoe attachment, E. T. Gilbert 588,977
Shutter bower and fastener, D. M. Stauffer 589,039
Sifter, ash, J. B. Gossman 588,980
Signal. See Railway signal.
Signal system, municipal, H. F. Eaton 588,965
Signals on locomotives, arrangement for notifying and recording way, Puyvallee & Meunier 589,272
Skate and ankle brace, C. Engberg 589,253
Sled, bob, L. Wiley 589,057
Smelting and refining furnace, reverberatory, B. Hall 589,210

(Continued on page 175)

DYNAMOS
For Lighting and Plating
20 light - - - $ 40.00
50 light - - - 75.00
100 light - - - 125.00
MOTORS
¼ h. p., $15; ½ h. p., $25; 1 h. p., $40; 2 h. p., $60.
Storage batteries and propeller wheels for boats. **EVANS ELECTRIC CO.**
61 and 63 N. Ashland Ave., Chicago, Ill.

PORTABLE SINGLE RAIL SURFACE Railway.—Details of construction and description of rolling stock of a new system of portable railway which may be laid upon ground that has received no special preparation for its reception. With 19 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1014.** Price 10 cents. To be had at this office and from all newsdealers.

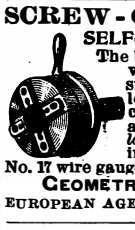
IT COSTS NOTHING TO TRY!

All steam users can save time money and trouble with the simplest, safest and most satisfactory trap in existence—the **HEINTZ STEAM TRAP** Guaranteed never to wear out. Look at the cut and see how it's done! Pay me what you save in coal for one year and I'll furnish the trap free. ☞ See illus. notice Sci. Am. July 31, 1897. Sole American Mfr.
Wm. S. Haines, S 136 S. 4th St., Phila., Pa.

MODEL WORK
We are prepared to assist the trade and inventors in solving mechanical problems, also manufacturing models and stock.
CENTURY MACHINE CO., 576 W. Broadway, New York
Complete outfit of modern machinery and tools.

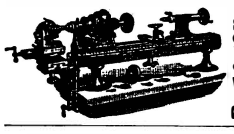
ACETYLENE APPARATUS.—ACETYLENE number of the SCIENTIFIC AMERICAN SUPPLEMENT, describing, with full illustrations, the most recent, simple, or home made and commercial apparatus for generating acetylene on the large and small scale. The gas as made for and used by the microscopist and student; its use in the magic lantern. The new French table lamp making its own acetylene. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1057.** Price 10 cents. To be had at office.

SCREW-CUTTING DIE HEADS
SELF-OPENING and ADJUSTABLE.



The best die head on the market. Some advantages over "others," viz.: They are smaller, stronger, more compact, have no levers to spring, cannot be clogged by chips, are always reliable, and the prices are right. ☞ *Send for descriptive circular "S A."* Our die heads are furnished in sizes suitable for cutting threads from No. 17 wire gauge to 6 inches diameter inclusive.
GEOMETRIC DRILL CO., WESTVILLE, CT.
EUROPEAN AGENTS: CHAS. CHURCHILL & CO., London, England. WHITE, CHILD & BENEY, Vienna, Austria.

The Van Norman • • Universal Bench Lathe.

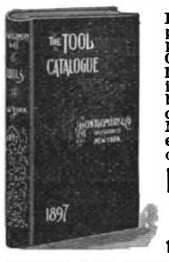


A Lathe, Milling Machine, Screw Cutter and Universal Grinder in one tool. The best tool made for all kinds of small work. Made by
Waltham Watch Tool Co.
SPRINGFIELD, MASS.
☞ *Send for Catalogue.*

Preserve Your Papers.

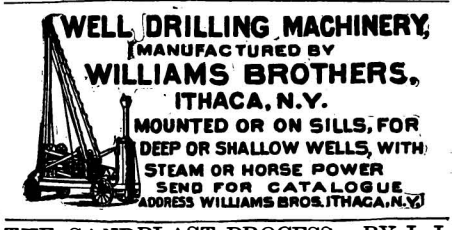
Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT, who wish to preserve their papers for binding, may obtain the Koch Patent File at the office of this paper. Heavy board sides, inscription "Scientific American" and "Scientific American Supplement" in gilt. Price $1.50, by mail, or $1.25 at this office. Address
MUNN & CO., 361 BROADWAY, NEW YORK

"It Tells About Tools"



Every Mechanic, Metal Worker, or person interested in Machinery Supplies should have our new 1897 Tool Catalogue. It contains 710 pages, size 10½x7½, and is an exhaustive and instructive list of all tools that may be required. Handsomely bound in cloth, express paid on receipt of $1. Money paid for book will be refunded with first order amounting to $10 or over. *Send stamps or money order.*
MONTGOMERY & CO.
MAKERS AND JOBBERS IN
FINE TOOLS,
105 Fulton Street, New York City.

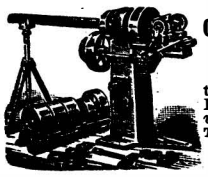
MODERN PHOTOGRAVURE METHods.—By Horace Wilmer. An interesting description of the process of making photogravure plates for illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1007.** Price 10 cents. To be had at this office and from all newsdealers.



WELL DRILLING MACHINERY,
MANUFACTURED BY
WILLIAMS BROTHERS,
ITHACA, N.Y.
MOUNTED OR ON SILLS, FOR DEEP OR SHALLOW WELLS, WITH STEAM OR HORSE POWER
SEND FOR CATALOGUE
ADDRESS WILLIAMS BROS. ITHACA, N.Y.

THE SANDBLAST PROCESS.—BY J. Holtzapffel. A full description of this interesting process and of the apparatus employed; with a discussion of its capabilities and present and future applications. With 8 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1010.** Price 10 cents. To be had at this office and from all newsdealers.

ARMSTRONG'S PIPE THREADING
—AND—
CUTTING-OFF MACHINES



Both Hand and Power.
Sizes 1 to 6 inches.
Water, Gas, and Steam Fitters' Tools, Hinged Pipe Vises. Pipe Cutters. *Stocks and Dies universally acknowledged to be* THE BEST. ☞ *Send for catalog.*
THE ARMSTRONG MFG. CO.
Bridgeport, Conn.

Machine Design
Mechanical & Architectural Drawing; Marine, Stationary and Locomotive Engineering; Sheet Metal Pattern Cutting; Plumbing; Electricity; Railroad, Municipal, **31 COURSES** Hydraulic & Bridge Engineering; Surveying and Mapping; Book-Keeping; Shorthand; English Branches; Architecture; Mining; Metal Prospecting. All who study **GUARANTEED SUCCESS.**
Fees Moderate, Advance or Installments.
Circular Free; State subject you wish to study.
International Correspondence Schools, Box 942, Scranton, Pa.

MICHIGAN COLLEGE OF MINES
A State technical school. Practical work. Special facilities for men of age and experience. Elective system. 45 weeks a year. Non-resident tuition $150 a year. For Catalogues, address
DR. M E. WADSWORTH, President, Houghton, Mich.

COMMERCIAL SPANISH
THE NEW BOOK. FITS YOU TO DO SPANISH BUSINESS CORRESPONDENCE. POSTPAID. **$1.00.**
RIO PUBLISHING CO.
255 HANDEL HALL, CHICAGO.

Imperial Darning Machine

Will put a fresh heel or toe in a stocking in two minutes. Mends Tablecloths, Curtains, Underwear, and all Fabrics A most wonderful success and the greatest addition to a lady's worktable. Saves the eyes and temper and does away with that tedious old-fashioned way of picking up the stitches. Send 25 cents in money or postal note, and machine will be sent free of all charges to your address.
AGENTS WANTED.
All instructions and samples sent with machine.
Standard Novelty Co., Dept. 8, 101 Beekman St., N. Y.

The Berkefeld House Filter.

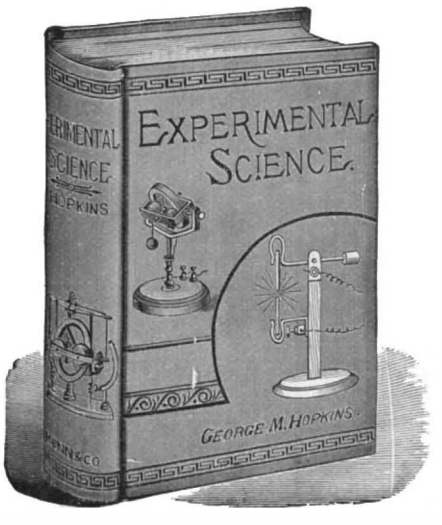
The only Filter Removing Typhoid and Cholera Bacilli. Tested and indorsed by many leading authorities in Europe and America. It gives a continuous flow of filtered water, absolutely free from germs. It is easily cleaned, as all impurities remain on the surface of the filtering cylinder. Cylinders can be sterilized by boiling in water for one hour. Send for circulars and prices to the **Berkefeld Filter Co., 4 Cedar St., New York**
See Illus. Article in Scientific American, June 23, 1894.

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Apparatus for making the gas. Contained in SCIENTIFIC AMERICAN SUPPLEMENT. Nos. **998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035** and **1038.** The most recent apparatus of simple and more elaborate type described and illustrated in special acetylene Supplement No. **1057.** Price 10 cents each. To be had at this office and from all newsdealers.

The Automatic Neostyle

produces 2,000 perfect copies from one original writing or typewriting, 30 copies per minute. The machine is easy to operate, as nearly all the work is done automatically. References to leading concerns now using it.
NEOSTYLE CO., 96-102 Church Street, New York City

Experimental Science
By GEO. M. HOPKINS.
17th Edition Revised and Enlarged.



840 pages, 782 fine cuts, substantially and beautifully bound. Price in cloth, by mail, **$4.** Half morocco, **$5.**

This splendid work is up to the times. It gives young and old something worthy of thought. It has influenced thousands of men in the choice of a career. It will give anyone, young or old, information that will enable him to comprehend the great improvements of the day. It furnishes suggestions for hours of instructive recreation.

Send for illustrated circular and complete table of contents. . . .

MUNN & CO., Publishers,
Office of the . . .
SCIENTIFIC AMERICAN,
361 BROADWAY, - NEW YORK.

© 1897 SCIENTIFIC AMERICAN, INC.

Ready Sept. 15th.

MAGIC

Stage Illusions and Scientific Diversions
Including Trick Photography.

COMPILED AND EDITED BY
ALBERT A. HOPKINS.

WITH AN INTRODUCTION BY
HENRY RIDGELY EVANS.

Over 500 pages. Over 400 illustrations.

This is a new and unique work on magic art. It contains exposés of the sleight-of-hand feats and illusions of the most famous conjurors of modern times. It is profusely illustrated with over 400 engravings. The subjects treated include interesting Biographies of Celebrated Conjurors, the Mysteries of Modern Magic, Ancient Magic, Science in the Theater, Automata, Curious Toys, and Photographic Diversions. The very latest developments in each line will be given. Thus, under photography the projection of moving pictures is taken up for the first time in book form.

An illustrated circular of this work is now ready, and will be mailed on request to any part of the world.

The book will be sent, postpaid, on receipt of **$2.50.**

MUNN & CO., PUBLISHERS,
361 BROADWAY, NEW YORK CITY.

WOODEN TANKS,
For Railroads, Mills and Manufactories.
Builders of Steel Towers and Tanks.
La. Red Cypress Wood Tanks a specialty.
W. E. CALDWELL CO.,
217 E. Main Street, Louisville. Ky.

MANUFACTURE OF STARCH FROM Maize.—By J. Kriegner. Full details of the process. With one illustration. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1012.** Price 10 cents. To be had at this office and from all newsdealers.

SO SIMPLE A CHILD CAN USE THEM

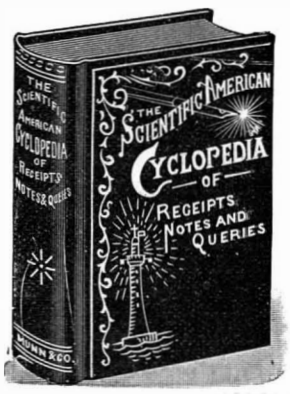
SUNART
MAGAZINE CAMERA.
Folding Cameras.
All sizes, ranging in price from $5 to $100. Sunart Junior, 3½ x 3½ picture, $5.
☞ Send 2 cent stamp for Illustrated Catalogue.
SUNART PHOTO CO.
5 AQUEDUCT STREET, ROCHESTER, N. Y.

COPY LETTERS
fifteen a minute, all legible, use my improved automatic copying machine.
☞ *Send for illustrated circular.*
JOHN H. ANDERSON,
910 Monadnock, CHICAGO.

Twelfth Edition Now Ready.

THE SCIENTIFIC AMERICAN
CYCLOPEDIA OF
Receipts, Notes and Queries

12,500 RECEIPTS. 708 PAGES.
Price, $5.00 in Cloth; $6.00 in Sheep; $6.50 in Half Morocco, Postpaid.



THIS great work has now been on the market for nearly six years, and the demand for it has been so great that twelve editions have been called for.

It is entirely distinct from the ordinary receipt book in being thoroughly up to date.

The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form, convenient for ready use. Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered.

Those who are engaged in almost any branch of industry will find in this book much that is of practical value in their respective callings. Those who are in search of independent business or employment, relating to the home manufacture of salable articles, will find in it hundreds of most excellent suggestions.

☞ *Send for descriptive circular.*

MUNN & CO., Publishers,
361 Broadway, New York.

Smoke consuming apparatus, A. A. Freeland..... 589,169
Sole indenting machine, boot or shoe, W. Gordon..... 588,978
Sower, hand seed, G. L. Gerhard..... 589,386
Spark arrester, B. Minzesheimer..... 589,213
Spinning frame, J. C. Judge..... 589,176
Stacker, pneumatic straw, J. J. Green..... 588,983
Stacker, pneumatic straw, C. C. Hiers..... 589,125
Stacker, pneumatic straw, F. Stanley..... 589,146
Stamp, hand, C. W. Martin..... 589,007
Staples into boxes, apparatus for forming and driving, E. Williams..... 589,058
Steam and hot water boiler, A. Catchpole..... 588,952
Steam boiler, L. E. Solignac..... 589,227
Steamer, face, M. E. Harris..... 588,989
Steamer, grain, E. T. Butler..... 589,334
Steel, hard body for rifling chromated, F. Chaplet..... 589,161
Steering gear, fluid pressure, C. E. Bergman..... 588,946
Stereoscope, H. C. White..... 589,055
Stone, cutting, Wincgz & Machepy..... 589,199
Stopper or cover for bottles, jars, or similar vessels, Reiser & Sutcliffe..... 589,097
Storage battery, W. J. Still..... 589,042
Store service apparatus, T. E. Barrow..... 589,238
Suppository mould, L. J. Harvey..... 588,990
Swing, rocking, A. Mathews..... 589,262
Switch. See Ground lever switch. Railway switch.
Syringe nozzle, A. McTernen..... 589,017
Table. See Extension table. Pool and billiard table. Whist table.
Tap, cooler and pump, combined beer, W. B. Baker..... 589,237
Teeth and making same, artificial, H. E. Dennett 589,383
Teeth, artificial, S. S. Bloom..... 589,332
Thill coupling, A. H. Worrest..... 589,063
Thread cutter and reel or spool, combined, H. V. Dodd..... 589,341
Ticket holder, S. S. Eccleston..... 589,344
Tidal motor, C. A. Prescott..... 589,367
Tire armor, bicycle, M. Choquette..... 589,163
Tire, pneumatic, W. Menzies..... 589,185
Tire, rubber, Palmer & Denmead..... 589,022
Tire shield, pneumatic, M. O'Brien..... 589,019
Tobacco pipe, W. S. Hannaford..... 589,258
Tool, combination, W. A. Zietzke..... 589,200
Tool holder, J. M. Richardson..... 589,303
Tooth cleaner, F. D. Gould..... 589,209
Toy, S. H. Harrington..... 588,988
Toy, F. E. Henke..... 589,173
Trap, H. S. Mariner..... 589,183
Trolley, A. O. Wyman..... 589,109
Truck, car, J. Linden..... 589,002
Truck, car, J. Player..... 589,271
Truss, hernial, J. T. Dugger..... 588,964
Tug, hame, W. O. Schellhammer..... 589,034
Turnbuckle forming machine, H. Markhoff, Sr... 589,182
Turning machine, wood, N. Meyers..... 589,092
Type font, Johnson & Low..... 588,996
Typewriter, J. Gilbert..... 589,387
Typewriting machine, O. Tyberg..... 589,233, 589,234
Typewriting machine copy holder, E. B. Bingham..... 589,330
Unicycle, Dornseif & Moser..... 589,249
Valve, E. Evertsen..... 589,124
Valve, combined equalizing stopand check, A. S. Roseberry..... 589,142
Valve device for compound engines, emergency, C. J. Mellin..... 589,184
Valve or faucet, L. Simmons..... 589,102
Valve, sealed gate, G. E. Martin..... 589,006
Vehicle brake, J. Ferrel..... 588,968
Vehicle, motor, G. Langer..... 589,001
Vehicle running gear, A. A. Holt..... 589,127
Vehicle washing device, C. B. Emery..... 589,345
Vehicle wheel, C. K. Welch..... 589,235
Vehicles, mechanical movement for propelling, H. J. Jensen..... 589,353
Velocipede, E. L. Barton..... 589,328
Velocipede brake and coasting sprocket wheel, N. Wallerich..... 589,149
Ventilating system for buildings, G. T. Finagin.. 588,969
Vessel ballast log, S. Menzies..... 589,133
Washbench and step ladder, combined, J. H. Pflieger..... 589,192
Washboard, L. O. Brown..... 589,070
Washer. See Bottle washer.
Washing machine, L. D. & A. J. Hart..... 589,084
Washing machine, S. B. & T. M. Raley..... 589,194
Washing machine, I. N. Turnbaugh..... 589,319
Washing machine, G. T. Winters..... 589,059
Water gage, Hopkinson & Lowis..... 589,259
Water wheel, L. J. Holzhauser..... 589,350
Weighing and bagging apparatus, F. H. Richards 589,296
Weighing and bagging machine, F. H. Richards, 589,287, 589,295
Weighing and dispensing apparatus, coin controlled, F. H. Richards..... 589,294
Weighing and packing apparatus, F. H. Richards 589,301
Weighing machine, F. H. Richards..... 589,273, 589,274
589,276, 589,278 to 589,285, 589,288 to 589,293
589,297 to 589,300, 589,302
Weighing machine, automatic, F. H. Richards, 589,275, 589,277, 589,286
Welding compound, T. Odlum..... 589,218
Wheel. See Bicycle wheel. Car wheel. Vehicle wheel. Water wheel.
Wheel, J. P. Northey..... 589,191
Whiffletree clip and hook, combined, C. E. Coe... 589,122
Whiffletree hook, J. P. Elkjer..... 589,077
Whist table, duplicate, J. W. Johnson..... 589,089
Window, L. S. Bradshaw..... 589,242
Window chair, F. Kawecky..... 589,177
Wire or cable tightener, A. Huber..... 588,994
Wire stretcher, G. Hanke..... 589,082
Wrench. See Pipe wrench. Quick action wrench.
Wrench, L. A. Smith..... 589,312
Wrench, Stephens & Prudhomme..... 589,228
Wrench, C. A. Terry..... 569,046
Yoke, neck, J. Ziegler..... 589,325

DESIGNS.

Bath tub leg, C. F. Arrott..... 27,599
Bedstead mount, W. K. Pine..... 27,600
Bicycle frame, J. M. Andersen..... 27,618
Button hook handle, P. H. Long..... 27,590
Carpet, W. F. Brown..... 27,619
Chair, D. W. Kendall..... 27,596, 27,597
Chair seat, bent wood, F. A. Dennett..... 27,595
Coffee pot strainer clip, C. F. Downey..... 27,594
Dish, C. J. King..... 27,593
Display rack, W. F. Scott..... 27,603, 27,604
Game board, Dandaraw & Gordon..... 27,591
Gas meter prover frame, J. H. Mansur..... 27,611
Ice shredder, H. L. Schwarzenberg..... 27,613
Kitchen utensil, H. L. Schwarzenberg..... 27,614
Knife handle, W. C. Codman..... 27,588
Lamp dome, street, D. J. Prendergast..... 27,605
Lock casing, W. D. Roberts..... 27,609
Oil can, C. L. Wagandt..... 27,615
Parcel carrier, J. P. Smith..... 27,617
Puzzle box or case, G. L. Smith..... 27,592
Register plate, hot air, F. O. Farwell..... 27,606
Saddle seat, H. A. Rusch..... 27,616
Scale face plate, J. H. Swihart..... 27,607
Shoe vamp, E. L. Sprague..... 27,585
Silversmith's stock, S. W. Babbitt..... 27,587
Skirt holder, R. M. Steindler..... 27,586
Spoons, etc., handle for, A. G. Rogers..... 27,589
Stocking, bathing, E. A. Guinzburg..... 27,582
Stool leg, J. B. Aufuldish..... 27,598
Stove, gas, L. J. Grinberg..... 27,612
Suspender end, W. Bloomberg..... 27,584
Tray, L. Weil..... 27,602
Tray for cigars, etc., C. H. Hahn..... 27,601
Undergarment reinforce, M. Steiner..... 27,583
Whiffletree hook, A. L. Clark..... 27,608

TRADE MARKS.

Beer, lager, Aktienbrauerei zum Lowenbrau in Munchen..... 30,527, 30,528
Butter, Elgin Creamery Company..... 30,530
Canned fruits and vegetables, N. C. Cummings & Brother..... 30,529
Steers, corn fed, H. H. Anthony & Company..... 30,531

LABELS.

"Registered Label of the Rocky Ford Melon Growers' Association," Rocky Ford Melon Growers' Association..... 6,556

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

KRAFTUBERTRAGUNGSWERKE RHEINFELDEN. Society for the Utilization of the Water Power of the Rhine N/Bale, Switzerland.
16,800 H. P. NOW AVAILABLE. TO BE INCREASED TO 30,000 H. P.
The Company is in a position to let electric energy at exceptionally cheap rates and on the most favorable terms. They also offer to applicants wishing to establish themselves near the works, suitable land on either the German (Badish) or the Swiss side of the Rhine, in the vicinity of important railway lines. Cheap labor.
For further information please address **The Manager, Kraftubertragungswerke, Rheinfelden, Switzerland.**

MODELS WE ASSIST INVENTORS. *Ideas for Asking.* | ☞ *Catalogue Free.* J. C. SEYL, 181 Madison St., CHICAGO.

FILMS For the Best Projecterscope or Kinetoscope Films, new list. F. L. WILLARD, 196 Lexington Avenue, Brooklyn, N. Y.

Experimental Pattern and Model Work, Optical, etc., instruments, bicycle sundries. EMPIRE NOVELTY WORKS, 402 E. 30th St., New York.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

SPECTACLES { F. E. BAILEY sells spex cheap. Write for new optical catalogue. 271 Wabash Ave., Chicago.

MODEL AND EXPERIMENTAL WORK
Draughting, Pattern Work, Special Machinery, etc.
S. P. Denison, 143 Center St., New York City

TYPE WHEELS. MODELS & EXPERIMENTAL WORK. SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

Experimental & Model Work
Cirs. and advice free. Gardam & Son, 45-51 Rose St., N.Y.

FOR SALE.—A First-class Foundry and Machine Shop, with a good business connection and a number of specialties. A good chance for an ambitious, hard working man. Address JOSEPH HILL, WARREN, PA.

MONEY made easily for the person who will buy my Patented Combination Tool. Every Mechanic, Farmer, and Artisan must have one. Will sell cheap. Address B. IBELLI, 139 Hudson St., B'klyn, N.Y.

FOR SALE. On account of moving into a new factory, we have for sale one 20 h. p. steam engine, one 30 h. p. boiler, and one steam elevator, all in good condition and with complete appointments. Easy payment if desired. G. A. Kent & Co., Binghamton, N.Y.

STRONG CASTINGS, QUICK DELIVERY.
PATTERN WORK TO ORDER.
ACME MALLEABLE IRON WORKS. BUFFALO. N.Y.

GOLD SAVED by sending for my 1897 Catalogue and Discounts on Architectural, Building, Mechanical, Electrical, Scientific and Technical Books. WM. T. COMSTOCK, 23 Warren St., New York.

ELECTRO MOTOR, SIMPLE, HOW TO make.—By G. M. Hopkins. Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

CARBORUNDUM
HARDEST ABRASIVE KNOWN. EMERY AND DIAMOND POWDER SUBSTITUTE. IN FLOUR, POWDER-CRYSTAL-WHEEL-SLAB & HONE FORM.
CARBORUNDUM CO., NIAGARA FALLS, N.Y. U.S.A.

HAWKINS' NEW CATECHISM OF ELECTRICITY
A PRACTICAL TREATISE
for Engineers, Electricians, Wiremen and Amateurs. 550 pages, 300 illustrations, bound in leather, pocketbook form, gold titles and edges. Strictly "Up-to-Date." Postpaid, $2.00. THEO. AUDEL & CO., 63 Fifth Avenue, New York.

Counterfeit Mileage Tickets.
B. & O. RR.

Recently there appeared in Pittsburg, a man giving the name of R. C. Lucas, accompanied by a woman calling herself May Anderson, who attempted to dispose of counterfeit B. & O. Mileage Books. They did succeed in selling some to the brokers, and then departed for Cleveland, where they registered at the American House as R. C. Lucas and wife.

In their efforts to dispose of the spurious tickets, they aroused suspicions, which were at once communicated to the B. & O. Agent, who immediately took suce action as led to the arrest and conviction of the woman, who was found guilty of selling counterfeit tickets, and sentenced to six months in the workhouse, and to pay a fine of $500 and costs.

The man succeeded in making his escape, but as he is known to the railroad people and the police, his arrest is only a question of time.

The B. & O. officials have taken every precaution to prevent the sale or use of these spurious tickets, and have expressed a determination to prosecute to the fullest extent of the law anyone caught attempting to use counterfeit mileage or other bogus forms of transportation, and will be especially vigorous against brokers found offering them for sale.

PROPOSALS.

NEW EAST RIVER BRIDGE, COMMISSIONERS' Office, New York, August 31, 1897.—Separate proposals will be received by the Commissioners of the New East River Bridge at their office at No. 49 Chambers street, New York City, at 2 o'clock in the afternoon of Wednesday, September 22, 1897, endorsed "Proposal for Construction of Brooklyn (or New York) Anchorage of New East River Bridge," for furnishing materials for and constructing the anchorages of the New East River Bridge, in accordance with the proposed form of contract and the plans and specifications therefor. All bids shall be enclosed in sealed envelopes, addressed to A. D. Baird, President of the Board of Commissioners of the New East River Bridge, and presented to him on that day and at that hour at said office, and such bids will be opened in public meeting by the Commissioners on that day at 2 o'clock.

Copies of the specifications and the general drawings of the work, with the proposed form of bid and contract, may be seen and further information will be given at the office of the Chief Engineer, No. 84 Broadway, Brooklyn.

Proposals will be made upon a form provided therefor, and only those proposals will be considered which are complete, in proper form, comply with the requirements herein stated, and are offered by parties of known reputation, experience and responsibility.

Each bidder will be required to deposit, with his proposal, in the office of the Commissioners, a certified check for $10,000, payable to the order of Richard Deeves, as Treasurer of the New East River Bridge Commissioners, as security for the execution by him of the contract and the giving of the required bond, if his bid is accepted, within two weeks after notice of the acceptance of his bid.

The contractor will be required to give a bond in the penal sum of $350,000, in the form annexed to the proposed form of contract, with two approved sureties or an approved Surety Company, conditioned for the prompt and faithful performance of the contract, and its covenants and the work thereunder.

Bids for the Brooklyn and New York anchorages, if both are bid for, must be made separately.

The Commissioners reserve the right to reject any and all of the proposals offered, and to accept any proposal offered. ANDREW D. BAIRD, President.
F. B. THURBER, Secretary.

50 YEARS' EXPERIENCE.

PATENTS

TRADE MARKS, DESIGNS, COPYRIGHTS &c.

Anyone sending a sketch and description may quickly ascertain, free, whether an invention is probably patentable. Communications strictly confidential. Oldest agency for securing patents in America. We have a Washington office.
Patents taken through Munn & Co receive special notice in the

SCIENTIFIC AMERICAN,

beautifully illustrated, largest circulation of any scientific journal, weekly, terms $3.00 a year; $1.50 six months. Specimen copies and HAND BOOK ON PATENTS sent free Address
MUNN & CO.,
361 Broadway, New York.

CONTRACT WORK EXECUTED FOR LIGHT MECHANICAL SPECIALTIES
BETTYS & MABBETT CO. 29 NORTH WASHINGTON ST. ROCHESTER N.Y.

WE MAKE THE BICYCLE ELECTRIC LIGHT, . $3.00
Carriage Electric Lights, . . . $4.00
Necktie Electric Lights, . . . 1.50
Table Lamps for Battery, . . . 1.55
Agents Wanted. ☞ *Send for new Catalogue* *Just out.*
OHIO ELECTRIC WORKS CLEVELAND, U. S. A.

HARDTMUTH'S "Koh-i-noor" **DRAWING PENCILS AND COPYING PENCILS**
are the **Best** Pencils manufactured in the world. Every architect, draughtsman, engineer, copyist, clerk, and everyone using pencils, should try the **Koh-i-noor**
Once tried, always used thereafter. For sale by all Stationers and Artists' Material Dealers. ☞ *Sample free on application.* **FAVOR, RUHL & CO.,** Importers, **121 West Houston Street, New York.**

A. W. FABER
Manufactory Established 1761.
LEAD PENCILS, COLORED PENCILS, SLATE PENCILS, WRITING SLATES. STEEL PENS, GOLD PENS, INKS, PENCIL CASES IN SILVER AND IN GOLD, STATIONERS' RUBBER GOODS, RULERS, COLORS AND ARTISTS' MATERIALS.
78 Reade Street, . . . New York, N. Y.
Manufactory Established 1761.

THE CHICAGO DRAINAGE CANAL.—Description of a great engineering work undertaken to prevent the contamination of the city's water supply. With 6 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1017.** Price 10 cents. To be had at this office and from all newsdealers.

How to Build a Home

Those intending to build will find the very best practical suggestions and examples of Modern Architecture in the handsomest Architectural Magazine ever published . . .

"The Scientific American Building Edition."

Each number is illustrated with a *Colored* plate and numerous handsome engravings made *direct from photographs of buildings*, together with interior views, floor plans, description, cost, location, owners' and architects' names and addresses. The illustrations include seashore, southern, colonial and city residences, churches, schools, public buildings, stables, carriage houses, etc.

All who contemplate building, or improving homes or structures of any kind, have in this handsome work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

PUBLISHED MONTHLY. SUBSCRIPTIONS $2.50 A YEAR. SINGLE COPIES 25 CENTS.
For sale at all news stands, or address **MUNN & CO., Publishers, 361 Broadway, New York**

© 1897 SCIENTIFIC AMERICAN, INC.

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

For some classes of Advertisements, Special and Higher rates are required.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

"Magnolia"
BEST ANTI-FRICTION METAL
MAGNOLIA METAL CO.
266 & 267 WEST STREET, NEW YORK CITY.
CHICAGO OFFICE: 59 Traders' Bldg. LONDON OFFICE: 49 Queen Victoria St., London, E. C.

CLOUD PHOTOGRAPHY AND GENERAL LANDSCAPE WORK CAN BE SUCCESSFULLY ACCOMPLISHED ONLY WITH THE
RAY FILTER
ILLUSTRATED BOOKLET FREE
BAUSCH & LOMB OPTICAL CO.
DEPARTMENT 4. ROCHESTER N.Y.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

Standard of the World.

1897 Columbia Bicycles

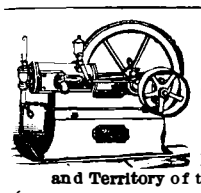
$75

TO ALL ALIKE.

The 5% Nickel Steel Tubing used in 1897 Columbias costs more than any other steel tubing on the market. The expense incident to this construction is justified by the advantages which it enables us to offer to the rider, both in safety, stiffness of tubular parts and consequent ease of running. This is indicated by the regard in which '97 Columbias are held by all riders.

1897 Hartfords $50
Hartford Pattern 2, Women's 45
Hartford Pattern 1, Men's . 40

POPE MFG. CO., Hartford, Conn.
If Columbias are not properly represented in your vicinity, let us know.



PRINTERS
are appreciating the
Charter Gas and Gasoline Engine
Proof from nearly every State and Territory of the Union, by addressing
CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

GARDNER GRINDER FOR FLAT SURFACES ACCURATE & RAPID FOR UP TO DATE SHOPS
C. H. BESLY & Co. CHICAGO. ILL. U.S.A.

BALL BEARING AXLES AND RUBBER Tires.—A paper read before the Carriage Builders' National Convention, Philadelphia, October, 1894, showing the advantage to be derived from the use of ball bearings and pneumatic tires in road vehicles. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **992.** Price 10 cents. To be had at this office and from all newsdealers.

PATTON'S SUN PROOF PAINTS

Wouldn't you rather paint your house *once* with Patton's Paints, than *twice* with all-white-lead or any other paints? Half the cost, labor and trouble saved and double service and satisfaction gained by using Patton's Sun Proof Paints. To acquaint you with their worth, and help you to select right colors, we'll send
Patton's House Painting Model
(20,000 color combinations) postpaid, for 10c.
A book of information about painting, "How to Increase the Size of your House with Paint," and a Master Painter's Tinting Card, mailed for 2c. stamp.
JAS. E. PATTON CO., Milwaukee, Wis., U. S. A.

WILLIAMS' SHAVING SOAPS THE ONLY REAL SHAVING SOAPS
INCOMPARABLE FOR THEIR RICH CREAMY LATHER.
NO OTHERS SO SOOTHING HEALING LUXURIOUS.

WILLIAMS' SOAPS are for sale everywhere, but if your dealer does not supply you, we mail them—to any address—postpaid on receipt of price.

Williams' Shaving Stick, 25 cts.
Genuine Yankee Shaving Soap, 10 cts.
Luxury Shaving Tablet, 25 cts.
Swiss Violet Shaving Cream, 50 cts.
Jersey Cream (Toilet) Soap, 15 cts.
Williams' Shaving Soap (Barbers'), Six Round Cakes, 1 lb., 40c. Exquisite also for toilet. Trial cake for 2c. stamp

THE J. B. WILLIAMS CO.
Glastonbury, Conn., U.S.A.
LONDON, 64 Gt. Russel St.
SYDNEY, 161 Clarence St.

THOROUGH INSPECTIONS
HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.
AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY
STEAM BOILER EXPLOSIONS
J. M. ALLEN, President. W. B. FRANKLIN, Vice President.
J. B. PIERCE, Secretary. F. B. ALLEN, 2d Vice President.

The Difference
in cost between Sargent's Artistic Hardware and the poor stuff so often used is nothing compared with the great difference in the goods. Prospective builders need a copy of **"Sargent's Book of Designs,"** which will be sent free upon application to SARGENT & CO., 37 Chambers Street, New York.

DRY BATTERIES.—A PAPER BY L. K. Bohm, treating of open circuit batteries, historical dry batteries, modern dry batteries, Hellesen's battery, Bryan's battery, Koller's battery, and the efficiency of dry cells. With three illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1001.** Price 10 cents. To be had at this office and from all newsdealers.

MR. BOOKKEEPER,
do you know what the Comptometer is? It costs you nothing to find out. It will help you out on that trial balance. It insures accuracy, is twice as rapid as the best accountant and relieves all nervous and mental strain.
Write for Pamphlet.
FELT & TARRANT MFG CO.
52-56 ILLINOIS ST., CHICAGO.

Buy Telephones
THAT ARE GOOD--NOT "CHEAP THINGS."
The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits. Our guarantee and instruments are **both good.**
WESTERN TELEPHONE CONSTRUCTION CO.
250-254 South Clinton St., Chicago.
Largest Manufacturers of Telephones exclusively in the United States.

The Typewriter Exchange

1½ Barclay St., NEW YORK
156 Adams St., CHICAGO
38 Court Square, BOSTON
818 Wyandotte St., KANSAS CITY, MO.
We will save you from 10 to 50% on Typewriters of all makes.
Send for Catalogue

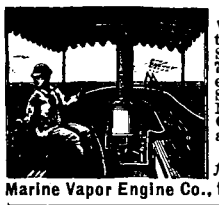
HALF A CENTURY OF CYCLES.—AN interesting history of the cycle from its origin up to the present time. The first crank-driven bicycle. The "bone-shaker" and its successors. The tricycle. The modern wheel. Cycle building a science. Points of improvement. The pneumatic tire. A hand and foot cycle. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1012.** Price 10 cents. To be had at this office and from all newsdealers.

PATENTED.
FIREPROOF, STRONG, LIGHT, FLEXIBLE, EASILY APPLIED.
ASBESTOS MATERIALS, LIQUID PAINTS, STEAM-PIPE AND BOILER COVERINGS, STEAM PACKINGS, ETC.
Illustrated descriptive lists and samples free by mail.
H. W. JOHNS M'F'G CO.
100 WILLIAM ST., NEW YORK.
CHICAGO. PHILADELPHIA. BOSTON. LONDON.

HOUTS AUTOMATIC TELEPHONE SWITCHES

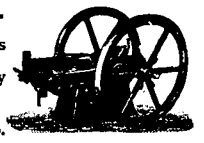
Some of its advantages: 1st. It is strictly automatic. 2d. It completely does away with the "manual" switchboard. 3d. Connection between subscribers is direct and instantaneous. 4th. No central office operator to hear, delay, or interrupt conversations. 5th. Uniform and uninterrupted service at all hours of day or night.
This appliance is sold outright or leased, at option of customer, and fully guaranteed.
Send for illustrated circular S. A. to **Houts Automatic Telephone Switch Co., Parker, So. Dakota, U. S. A.**

ALCO VAPOR LAUNCH

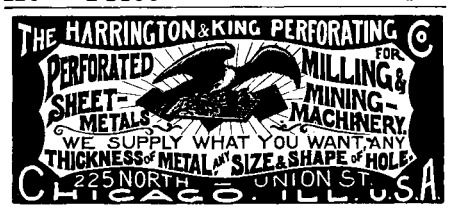


Motor controlled from bow. Valve movement, 12 to 1. 16 to 60 ft. Launches. Twin Screws a specialty. 1, 2, 3, 5, 7, 12, 14 and 20h. p. No licensed engineer or pilot required. Speed and safety guaranteed. No dangerous Naphtha or Gasoline used. No disagreeable vibration.
Send 10 cents in stamps for 1897 Catalogue.
Marine Vapor Engine Co., ft. Jersey Av., Jersey City, N. J.

POWER? POWER? POWER!
Fifty per cent. increase at no additional expense.
VICTOR VAPOR ENGINE.
LOCAL AGENTS WANTED.
Steam and Vapor Launches Row and Sail Boats.
Send for catalogue. Specify one wanted.
THOS. KANE & CO.
64-66 Wabash av., Chicago.



At ¼ Price Bicycles, Watches Guns, Buggies Harness, Sewing Machines Organs Pianos Safes, Tools Scales of all varieties and 1000 other articles Lists free CHICAGO SCALE CO. Chicago Ill.


THE HARRINGTON & KING PERFORATING CO.
PERFORATED SHEET-METALS
FOR MILLING & MINING MACHINERY
WE SUPPLY WHAT YOU WANT, ANY THICKNESS OF METAL ANY SIZE & SHAPE OF HOLE
225 NORTH UNION ST.
CHICAGO. ILL. U.S.A.

Which would you rely on?

We make our **"PIONEER"** Tube of Fifty Carbon Steel

Because a Tube like this of our "PIONEER" .50% CARBON STEEL

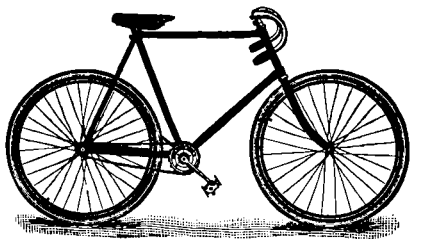
Is just as strong as a Tube like this of .25% CARBON STEEL

While WEIGHT FOR WEIGHT in a Bicycle our **FIFTY CARBON** Steel will last so long and **TWENTY-FIVE CARBON** Steel will last only so long . . . . .

NOTE THE FULL IMPORT OF THE PARALLEL LINES.

The comparison which they graphically make indicates the result of the prolonged investigations of the most practical experts of the world.
That the tests in our own laboratory corroborate these results is merely so much to its credit; that the same is true of actual trial on the road equally proves the trial to have been made in bicycles of correct design and construction. THE FACT REMAINS.
The margin of safety is greatly increased by the use of this tube. Every bicycle manufacturer should use it; every dealer should insist on having it; every rider should demand it.
Send for Catalogue. **THE POPE TUBE CO., HARTFORD, CONN.**

Tribune Bicycle
Tested and True.



The Easiest Running Wheel in the World.
Send for Catalogue.
THE BLACK MFG. CO., ERIE, PA.

For Business Opportunities in Virginia, address Paul Scherer, Industrial Agt. N. and W. Ry., Roanoke, Va.

FISCHER'S CIRCLE DIVIDER AND ANGLE PROTRACTOR

This instrument divides a circle into as many parts as there are eighths or sixteenths of an inch in its radius, by means of the points, which are marked "8" and "16." It is a very useful and time-saving novelty.
Instrument in cloth covered pocket case, with directions, postpaid $1.50. **KEUFFEL & ESSER CO., Manufacturers, 44 Ann Street, New York.**

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS Lᵗᵈ 91 JOHN ST. NEW YORK

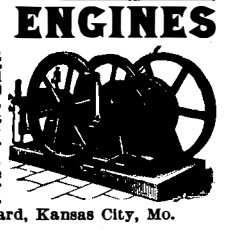
THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made, how to apply the written letter to the pad, how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

IMPERIAL BALL BEARING AXLE
A written guarantee with each set of axles.

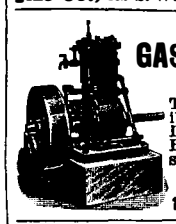
97 PATTERN
8,000 sets in use.
Indorsed by the leading carriage builders.
Reduces friction 75 per cent. One horse can do the work of two. Mechanically perfect. Can be put on old or new work.
Write for our Illustrated Catalogue and Testimonials, which we send free on application. Imperial Ball Bearing Axle Dept., 439 Wabash Avenue, Chicago, Ill.

This beats Wind, Steam, or Horse Power. We offer the
WEBSTER 2½ actual horse power GAS ENGINE
for **$150,** less 10% discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100 therefore we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline.
Write for Special Catalogue.
WEBSTER M'F'G CO.,
1074 West 15th Street, CHICAGO.

HOISTING ENGINES
operating on **GASOLINE, DISTILLATE or CRUDE OIL.** Both Friction and Geared Hoist, from 10 to 50 H. P., for **Mines, Quarries, Docks,** etc. Great Saving over steam, especially where wood, coal or water are scarce. Send for catalog. Guaranteed fully. State size wanted. Address **Weber Gas and Gasoline Engine Co.,** 402 S. W. Boulevard, Kansas City, Mo.



"WOLVERINE" GAS & GASOLINE ENGINES
STATIONARY AND MARINE.



The "Wolverine" is the only reversible marine gas engine on the market. It is the lightest engine for its power. Requires no licensed engineer. Absolutely safe. Manufactured by
WOLVERINE MOTOR WORKS,
12 Huron St., Grand Rapids, Mich.

New Supplement Catalogue!

An entirely New Supplement Catalogue is now ready for distribution; it includes all of the papers up to and including the first half of the year 1897. It is arranged on a clear and easily understood plan, and contains 10,000 papers more than the former one. It will be sent free to any address in the world on application.

A special edition on heavy paper, handsomely bound in cloth, has also been issued. It is supplied at the nominal cost of 25 cents, and thus enables the possessor to preserve this valuable reference catalogue.

MUNN & CO., Publishers,
361 Broadway, New York City.

ANTI-RUSTINE Prevents Rust on Machinery and Tools.
GOLDING & CO. BOSTON, MASS.

PRINTING INKS
The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St opp. Duane, New York

© 1897 SCIENTIFIC AMERICAN, INC.